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December 28, 1940

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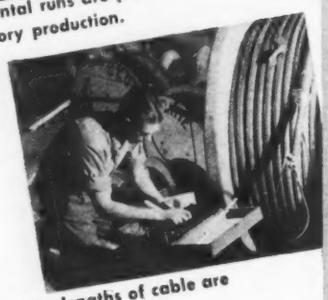

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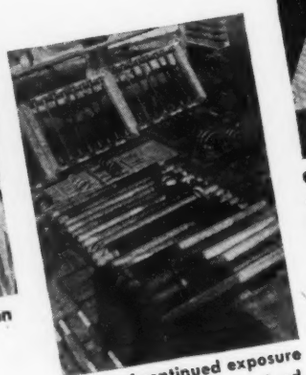


The effects of continued exposure to weather must be determined.

Cables are buried in soil, sand, and cinders for years, under full load, and periodically tested to determine the best for each condition.

The New Year

Seldom has it been more difficult to translate current economic directions into a forecast for a new year than it is today, for seldom have there been more conflicting trends.

We are told that the defense production program has bogged down and that the requirements of Great Britain as well as our own will be greater in the next twelve months. The President has insisted that while prices must be kept down there shall be no diminution of the social gains, which means higher labor cost through shorter hours and overtime—to say nothing of higher taxes.

It is the theory of the Administration that defense production shall be on top of a normal domestic economy and that the two together will lift the national income to new high figures—figures that will make it easier to absorb the increased government spending. At the same time we find priorities control broadened to include sub-contractors, with the implication that we may see a general extension of priorities.

In addition to such economic dilemmas there are major uncertainties which must be acknowledged in any contemplation of the new year. The war in Europe may end, and then again the United States may find itself at war. Either of these eventualities would cause a decided change in the national economy of the United States.

This we do know. The orders for electrical materials apparatus and supplies in 1940 are the largest ever booked in a single year. The electrical manufacturers as a whole are entering the new year with a record-breaking backlog of orders. The schedule for 1941 delivery of generating equipment sets a new all-time high. The utility construction budget for 1941 will be a quarter more than 1940 and the largest since 1930.

There is every reason to believe that load will continue to expand, especially industrial, but if priorities are widely invoked some estimates may have to be revised. We maintain, however, that with or without priorities there will be no power shortage.

In order to increase defense production there may be some labor shifting to permit the employment seven days a week of machinery and factory space. This, of course, would have the effect of increasing kilowatt-hour consumption without increasing the peak.

In spite of the fact that power is the number one raw material and that defense production is of paramount interest, no leniency is foreseen on the part of federal power regulatory agencies. In fact, an extension of the area of regulation is indicated by the recent Supreme Court decision in the New River case.

The year promises now to hang up a new record gross revenue for the entire electrical industry. We wish we could say the same for net.

In spite, however, of the apparent contradictions, in spite of the uncertainties, in spite of the financial, tax and regulatory problems, we feel from this vantage point that 1941 will be called a good year, a year of progress, and most decidedly a very interesting year.

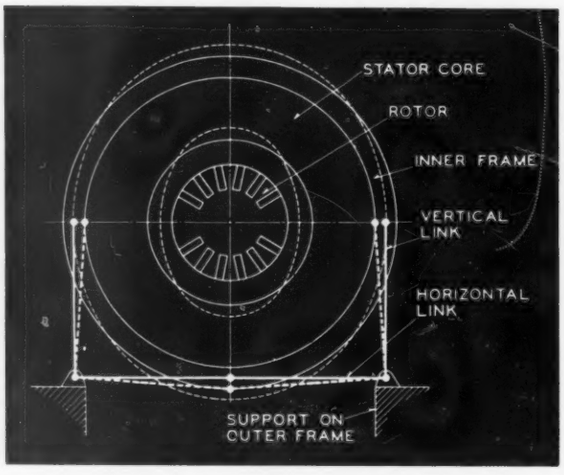
Vibration of Frame Reduced on Waterside Generator

Largest 3,600-r.p.m. alternator — Has resiliently mounted core which holds the over-all noise level to one decibel over no-excitation value

T. R. GALLOWAY, Consolidated Edison Co.; B. A. ROSE,* Westinghouse Electric & Manufacturing Co.*

THE NEW 81,250-kva. hydrogen-cooled generator for Consolidated Edison's Waterwide station, besides being the largest 3,600-r.p.m. machine of its kind in the world, embodies a resiliently mounted stator core which, on test, reduced the 120-cycle frame vibration to 0.00015 in. when no field is applied. With full field excitation the core vibration increased about 700 per cent over its no-excitation value, but the frame vibration increased only approximately 30 per cent. Over-all noise level averaged only one decibel more than the no-excitation value.

In 1936, when the first 50,000-kw., 3,600-r.p.m. generator unit was installed at the Waterside station of Consolidated Edison, it was noticed that the generator frame emitted a quite large volume of 120-cycle noise. Furthermore, although the generator frame was not vibrating excessively, it was transmitting vibration of the above frequency to the foundation and causing it to vibrate excessively at certain points. This condition of frame vibration and noise prevailed only when the generator field was excited.



STATOR VIBRATION of flexibly mounted generator

Solid lines—Normal position without field excitation. Dotted lines—One point in rotation with field on. Core weight of 81,250-kva. generator is taken by the vertical members, which also support the full load and short-circuit torque reactions. Horizontal supports hold the core in proper lateral position in outer frame. Any part of the core can move radially without being restrained by the mounting, but the assembly is securely held in proper position.

Walkway Vibrated

The foundation was built of structural steel and had attached to one side a concrete floor walkway approximately 8 ft. wide. The rigidity of the walkway, together with its attachment to the foundation, was such that the resonant frequency of the walkway coincided with the impressed frequency of 120 cycles per second. As a result, the vertical vibration of the walkway along its outer edge was excessive.

A study of the trouble was made and the conclusion reached that very little could be done to the generator to eliminate the trouble. Furthermore, it was recognized that the frame vibration was not excessive, and if some means of isolating the walkway from the main longitudinal girder of the foundation could be devised the trouble would be eliminated. This was done by the use of an auxiliary floor beam which was supported by the main foundation columns, but did not contact the foundation girders at points adjacent to the generator feet.

Above alterations eliminated the excessive walkway vibration, but did not reduce in any way the noise emitted from the machine. Furthermore, the generator vibration, being of such high frequency, was transmitted to other connected parts, causing trouble with pipe and railing vibration, failure of gauges and meters and in general causing a great amount of additional work before the unit and its connected apparatus could be classed as satisfactory.

This experience caused the Westinghouse company, which manufactured the unit, to begin an intensive development program to devise a means of either eliminating the cause of the vibration or isolating it from the foundation and connected apparatus. It was realized that appreciably larger two-pole generators than 50,000 kw. were desired, and if no provision for eliminating the vibration near its source was developed the problem of designing a foundation suitable for use with such a machine would be almost impossible and certainly not practical.

The magnetic flux between the two poles of the rotor and the stator bore is the primary cause of this vibration

*Engineer.

and noise. It produces an attractive force between the stator core and the field at each of the two field poles and these forces distort the stator from its circular shape into a slightly elliptical one. This elliptical shape follows the rotor around as it revolves, and as a result any spot on the stator core has a small vibratory motion. The frequency of this motion is twice that of rotation of the field by virtue of the fact that the rotating elliptical shape has two high spots and two low spots, all of which pass through a particular point on the stator during a single revolution of the field.

This vibratory motion is inherent in all alternating-current motors and generators, because the magnetic pull of the rotor on the stator is concentrated over the poles and tends, therefore, to pull the stator inward at these spots. The distortion of the stators of machines with more than two poles, however, is so small as to be unnoticeable, and that of small two-pole machines has been negligible.

The jump in capacity from approximately 15,000 kw. to 35,000 or 50,000 kw. produced relatively large increases in the vibratory motion of the stator core.

Factors influencing the magnitude of the motion may be expressed as:

$$\text{Motion} = C \times \frac{B^2 R^4}{H^3}$$

Where B = the air gap flux density.
R = the radius to the neutral axis of the stator core section beyond the slot.
H = the radial depth of the core section.
C = constant.

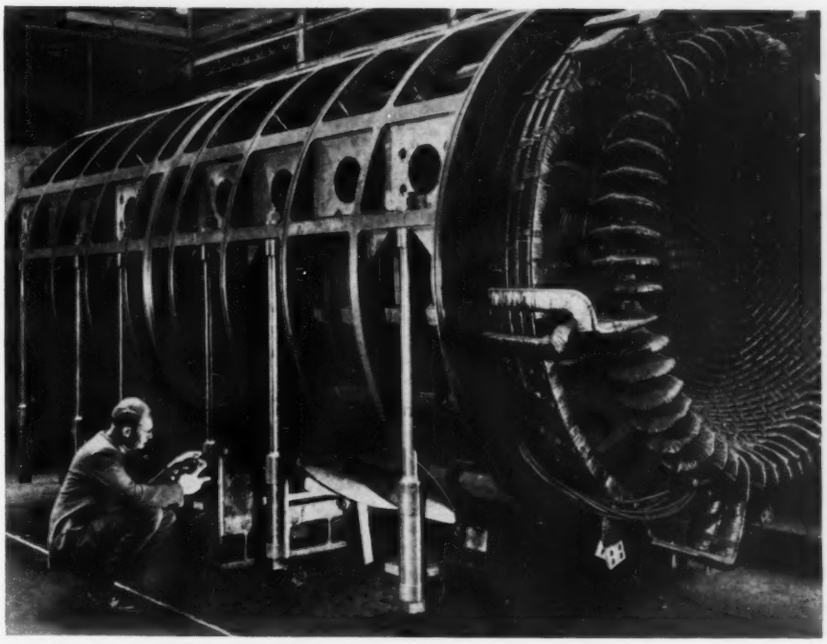
Changes in R are very effective in altering the magnitude of the motion.

Gap Densities

Improvement in the quality of iron in the stator laminations has allowed the use of higher air gap flux densities as well as higher flux densities in the section back of the stator slots. Because of this, increases in the diameter of machines (designated by R) have not been accompanied by proportionate increases in H. Because of this the large 35,000- and 50,000-kw. machines brought with them relatively large increases in the vibratory motion of the stator core.

Improvements can be obtained by increasing the core section so as to reduce the vibration to the desired amount. This becomes an expensive method if a reduction to one-fifth of

[*Continued on page 39*]



STATOR CORE and inner frame

Six vertical supporting members visible. B. A. Rose, co-author, is looking at one of the lateral and axial tie members horizontally placed below the frame; acting with the main members, they accurately support and center the core in the outer frame. Unit rated 81,250 kva., 65,000 kw., 13.8 kv., 60 cycles, 3,600 r.p.m., 0.9 short-circuit ratio when operating with an internal gas pressure of approximately 1 lb. per square inch. The generator (including exciter) weighs approximately 170 tons and is 31 ft. long. Alternating stresses due to radial motion of the stator core are less than 10 per cent of similar stresses in the shaft ends of the rotor and some parts of the stator frame housing.

NARROW CROSS-SLOTS neutralize tendency of vibration within rotor

In addition to frame vibration, there is a source of vibration within the rotor itself. The long, relatively slender rotor deflects twice each revolution due to the deep slots cut in opposite sides for field windings. These deflections set up a double frequency vibration within the rotor itself; this may cause wear of bearings and collector rings. By cutting narrow slots in the solid sections of the rotor the deflection along the two axes is equalized and the vibration is practically eliminated. Double amplitude vibration of the shaft at the collection rings is as follows (in inches):

Frequency	No Field	With Field
120	0.00025	0.00025
60	0.0005	0.0005

The rotor of this largest (81,250-kva.) 3,600-r.p.m. generator is a single forging 24 ft. long and weighing approximately 26 tons.

Series Capacitor Smoothes Jagged Voltage on Long Feeder

Grain elevator at end of 5-mile line caused 18-volt dips on secondary — Two 15-kva. units in parallel in ground side of 7.2-kv. line ironed out the voltage

C. H. SMITH, Otter Tail Power Company, Fergus Falls, Minn.*

CHIEF ADVANTAGES of the series capacitor over other forms of voltage regulation are:

1. The corrective action is instantaneous and in proportion to the current causing the voltage drop.
2. The losses within the capacitor are quite small.
3. There are no moving parts to require attention.

Within the past several months the Otter Tail Power Company has experimented with series capacitor installations with varying degrees of success. This power system includes several medium-voltage single- and three-phase stub lines feeding mixed power and lighting loads. These stub lines lend themselves to series capacitor installations in that the load is quite often all lumped at the end of the line. The power loads usually consist of relatively large induction motors operating for short periods of time, causing objectionable voltage dips on associated lighting circuits.

The first installation tried was quite successful. It was on the line of Fig. 2, feeding a mixed elevator and lighting load at Norcross, Minn. Loads of short duration up to 70 kva. have been measured on this line. The transformer is thermally capable of handling these short-time loads, but with considerable voltage drop. The 7.2-kv. circuit through line and transformer is largely reactive ($\frac{X}{R} = \frac{3}{1}$) and the power factor of the combined load is rather poor. There are no loads along the line. Therefore this appeared to be an ideal situation for a trial installation of series capacitors.

Capacitors should be placed at the load if possible to eliminate overvoltages due to heavy line fault currents. This presented a problem, however, as the Norcross load consists of several 7.2-kv. individually grounded distribution transformers. To pass the total load through a single capacitor installation would necessitate connecting them in the insulated conductor ahead of all transformers. This would require additional insulation to ground, and would also involve considerable overvoltage hazard due to 7.2-kv. circuit exposure within Norcross. It was decided, therefore, to locate the capacitors in the grounded lead of the supply transformer at Herman.

Simplified Determination

If all conditions are accurately known, the exact capacitor rating for a given voltage correction can be calculated. In smaller installations, however, it hardly seems worth while to

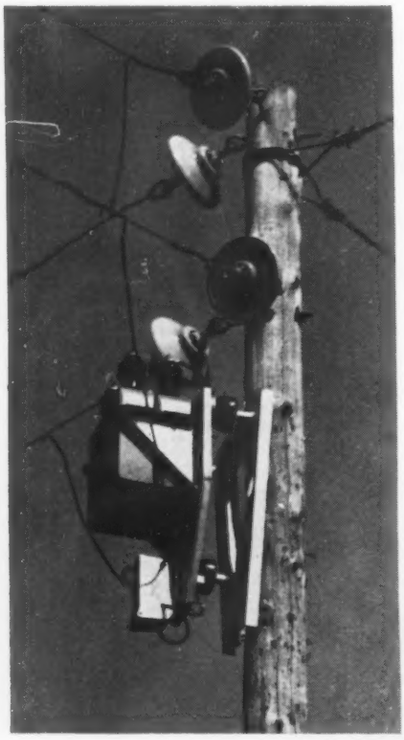


FIG. 1—30-Kva., 2.3-kv. series capacitor in a single-phase ungrounded line at Perham, Minn.
It was cut in series with a corner-pole jumper, thus eliminating additional insulators except for mounting the case. Three bus supports carry the capacitor on a triangular frame suitable for either pole or crossarm mounting.

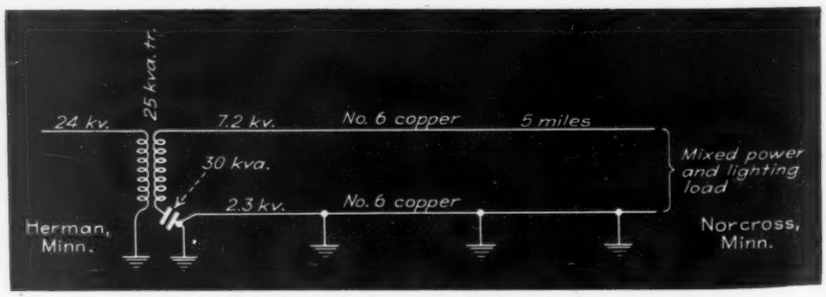


FIG. 2—FIVE-MILE, 7.2-kv. line of No. 6 copper subjected to voltage dips
The line is supplied from a 41.5-kv. grounded Y circuit through a 25-kva., 25-kv. transformer. Momentary loads of 70 kva. on this line caused the dips of Fig. 3b before the 30 kva. of 2.3 kv. series capacitors were installed as shown.

* Assistant electrical engineer.

calculate rigidly in view of the uncertainties involved in obtaining exact information. A simplified method of consideration based on essential test information, and followed by trial installations with further testing, has proved fairly satisfactory.

The information required is simultaneous recordings of load current and primary voltage. This latter can be obtained fairly closely from the secondary of a lightly loaded transformer. It is well to obtain the line power factor, but if this is inconvenient to obtain simultaneously, it can usually be assumed.

The maximum sustained current recorded (Fig. 3a) was $4.5 \times 2 = 9$ amp. The voltage dropped from 120 to 108, or 10 per cent. In terms of primary voltage, this drop is 10 per cent of 7,200, or 720 volts. A power factor of 85 per cent lagging was assumed for this sustained peak load.

Six Series Capacitors

Usually the more severe motor-starting conditions can be disregarded, except to make certain that excessive voltages are not developed across the capacitors. The heavy starting current through the capacitors at a lower power factor results in approximately enough correction to cancel the voltage drops due to motor starting. Drops due to arc welding are in many cases practically eliminated also.

A consideration of available ratings of standard shunt capacitors indicated that 30 kva. of 2,300-volt units, two 15-kva. units in parallel, connected in series with the line would be approximately correct. The full load current of this group is 13 amp., which allows 3 to 4 amp. margin over the peak loads recorded. With a load of 9 amp. the drop across the capacitors is 9/13 of 2,300 volts, or 1,590 volts.

At present the Otter Tail Power Company has six series capacitor installations, totaling 315 kva. All installations have been made using 2,300-volt Westinghouse unit, which seem best suited for use on 7.2- and 12.5-kv. lines. Three installations are single phase and three are three phase. Three installations were made at the load end of the line and three at the supply end. No capacitors have been lost through damage, even though the protection is not 100 per cent. This may indicate that they can stand considerable abuse, or it may indicate a certain amount of good luck. Where no grounded point was available the capacitors were mounted on a rack which is supported on insulators of the same rating as used in the line.

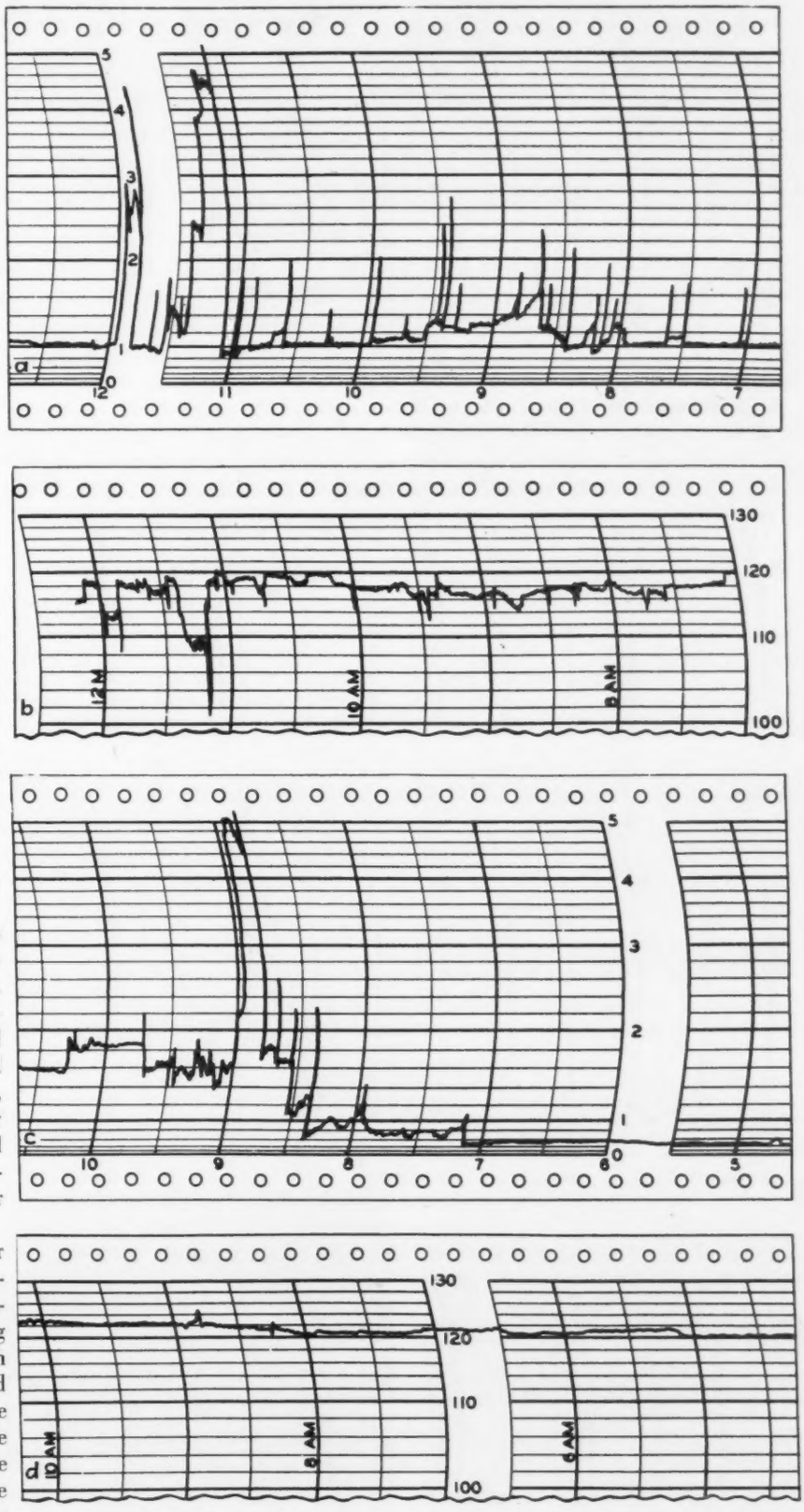
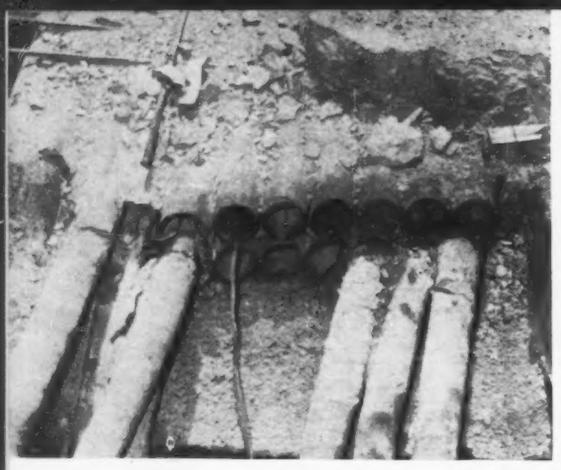


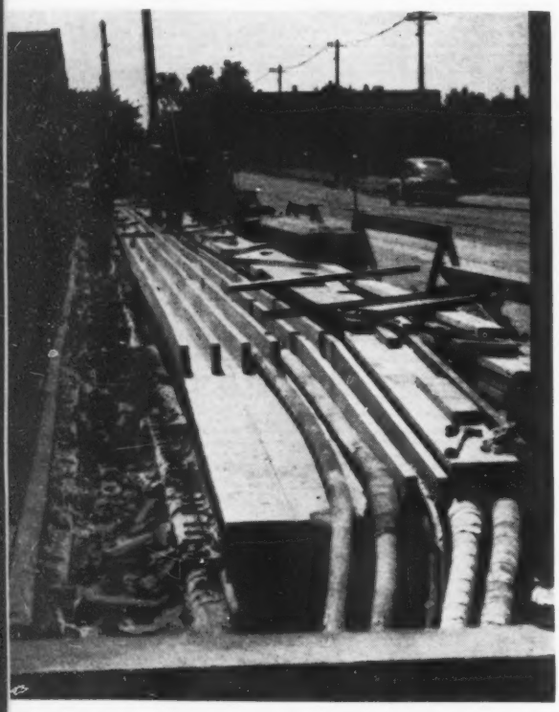
FIG. 3—SERIES CAPACITORS convert 19-volt dip into a 4-volt regulation—Nine amperes of sustained current on the 2.3-kv. line caused 12-volt sag (b) before the series capacitor installation, but an imperceptible change (d) afterward. Correction is practically complete for all values of load current. A small over-correction accompanied the starting of one motor

Conduit Line Rebuilt in

Existing cables removed to a temporary wooden duct while concreting the sidewalk bed for new duct line in viaduct over busy railroad tracks

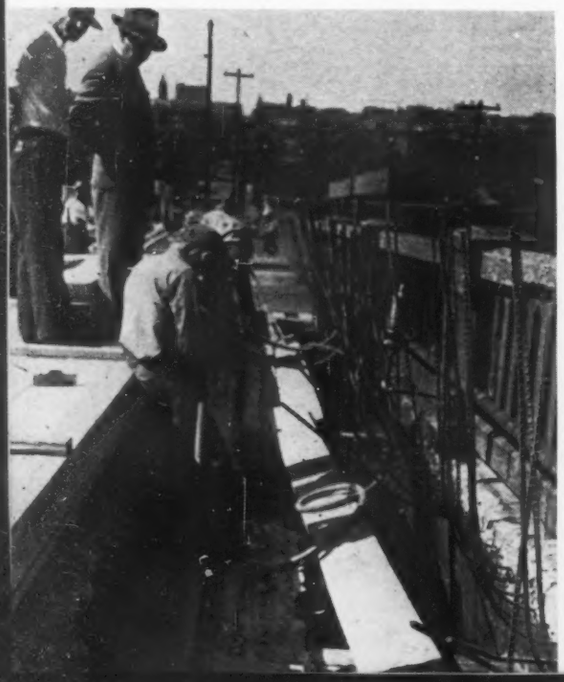


ORIGINAL DUCT was close spaced and had only a 5-in. concrete cover—hardly sufficient to allow for roof slab at manhole



WOODEN DUCT houses cables while new fiber duct line is built at left

REINFORCING STEEL cut and bent back. Air whistle (facing men) attached to compressor air line and operated by watchman to stop work over the exposed tracks when trains or railroad employees passed below



MANY YEARS AGO when the viaducts were being built across the terminal railroad tracks that run below grade across the city, the power company furnished the railroad company with 3½-in. fiber conduit to install in the sidewalk in anticipation of later on connecting up for conduit line crossings. This work was all done by contract; the conduits were laid adjacent to each other without spacing and without concrete between.

Large size cables and heavy loading have increased the hazard of this conduit line to the point where it was necessary to rebuild it, so a wooden circuit line was built on the part of the sidewalk not intended to be disturbed. Concrete and conduit were broken away from around the conduit, the steel was cut back and the cables removed and placed in the wooden conduit line.

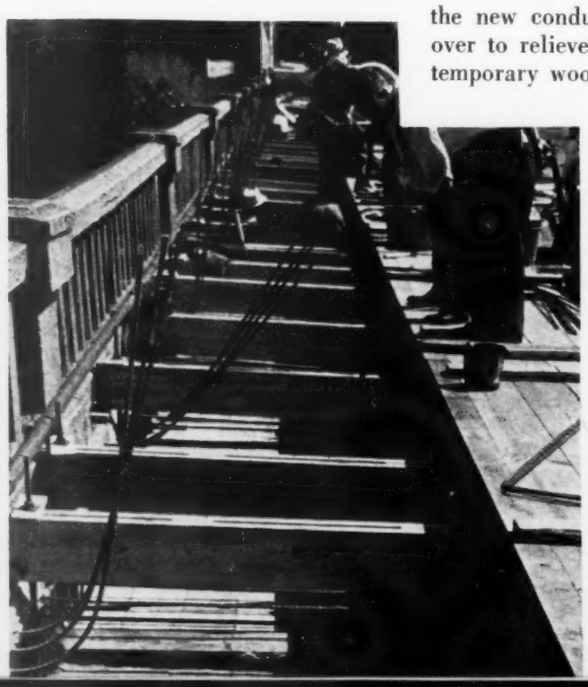
All of this work was done directly over the main passenger tracks over which nearly all passenger traffic entering the city has to go.

In order to facilitate removing the underneath forms without the need of long extension ladders and working around moving trains, a special procedure was followed. Ordinary ¾-in. iron pipe cut to sufficient length was cast in the concrete, with the top flush with the sidewalk surface and the lower end extending through the lower forms.

Special long threaded rods were made up by drilling the ends and inserting a short length of ¼-in. rod. Number 14 galvanized wire fastened into a hole in the end of the ¼-in. rod made it possible to allow the rod to be dropped down through the pipe to track level, where temporary 2 x 8-in. stringers were bolted on. The wire then was used to pull the 2 x 8 stringers up to a point about 4 ft. underneath the forms and was used to support a platform.

The men started with this platform at one end and worked straight on across to the other end without taking down the platform. When all work was finished the tracks below were cleaned of rock and broken concrete that had fallen through. Getting trucks out onto the tracks was difficult and dangerous, so a tractor with a boom and bucket was used.

New cables have been installed in the new conduit and are being cut over to relieve the old cables in the temporary wooden conduit line.

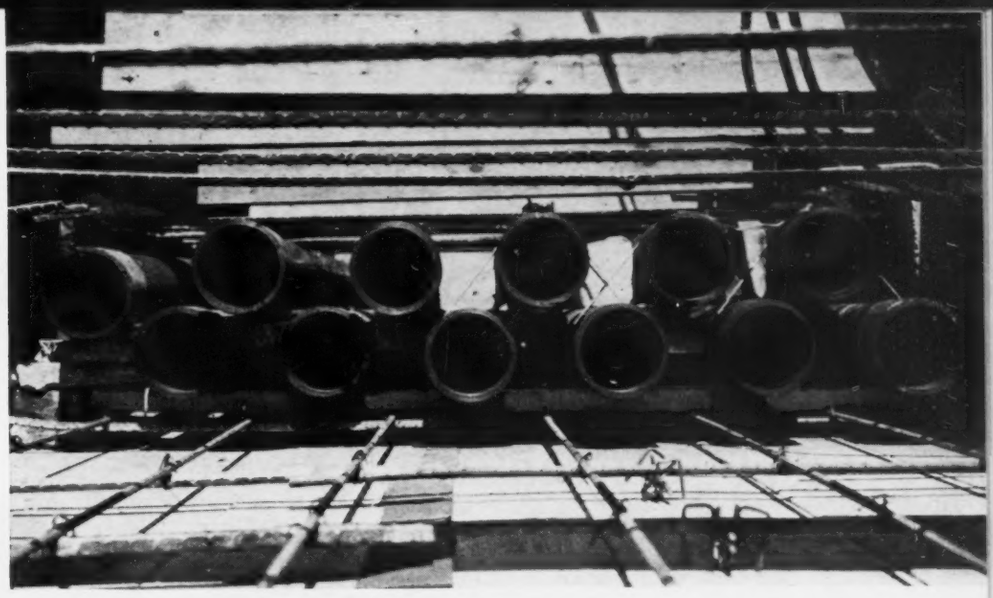


FLOOR for pouring new concrete suspended by pairs of 2x10 stringers

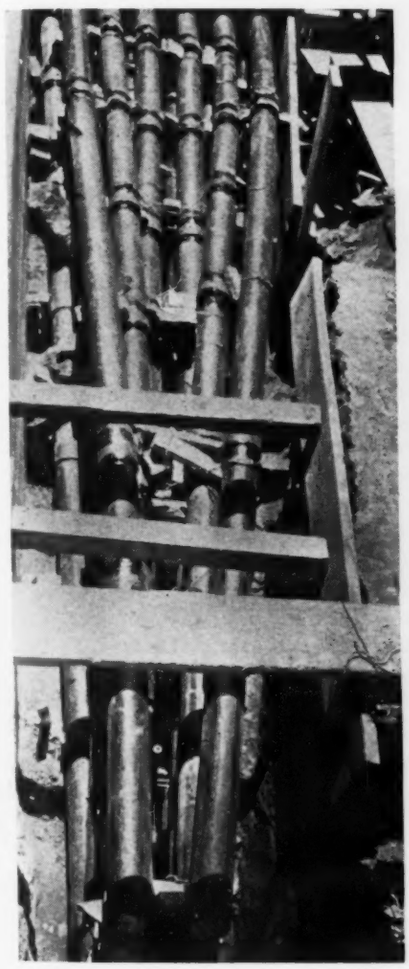
Long threaded rods at each end hold the stringers for the underneath forms. The steel reinforcing rods were then rewelded in place by means of a short piece of rod alongside the joints. Longitudinal reinforcement was also provided and cross-welded or tied. Laboratory tests showed the welds were as strong as or stronger than the steel itself.

Viaduct Sidewalk

T. G. HIERONYMUS,
Kansas City Power & Light Co.



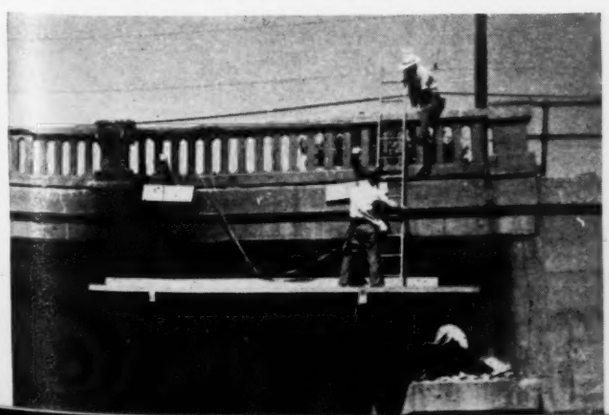
NEW duct line has a minimum of 1½-in. spacing between ducts



TRANSFORMATION from six-wide, two-high flat to the reverse in vertical arrangement at manhole entrance. Vertical configuration greatly facilitates racking, expansion and contraction

THREE expansion joints use 18-in. lengths of steel pipe as expansion sleeves for duct. One end of each pipe was cast in concrete, the other wrapped with tar paper to permit sliding in expansion. Duct seal plastic was put under the tar paper, expecting that it would be squeezed out with further expansion

WORK PLATFORM for concrete form removal was lifted up from track level by wires dropped through pipes set in the concrete for the purpose. Note safety belt roped to balustrade as an extra safety precaution for workmen (left). Tractor boom and bucket on viaduct safer means of removal of debris from railroad right-of-way than trucks driven among the tracks below (right)



Pole Class and Guying Determined From Charts

Nomograph gives the pole class for uniform strength for all spans — Other charts fix guy details for various slopes in uneven terrain

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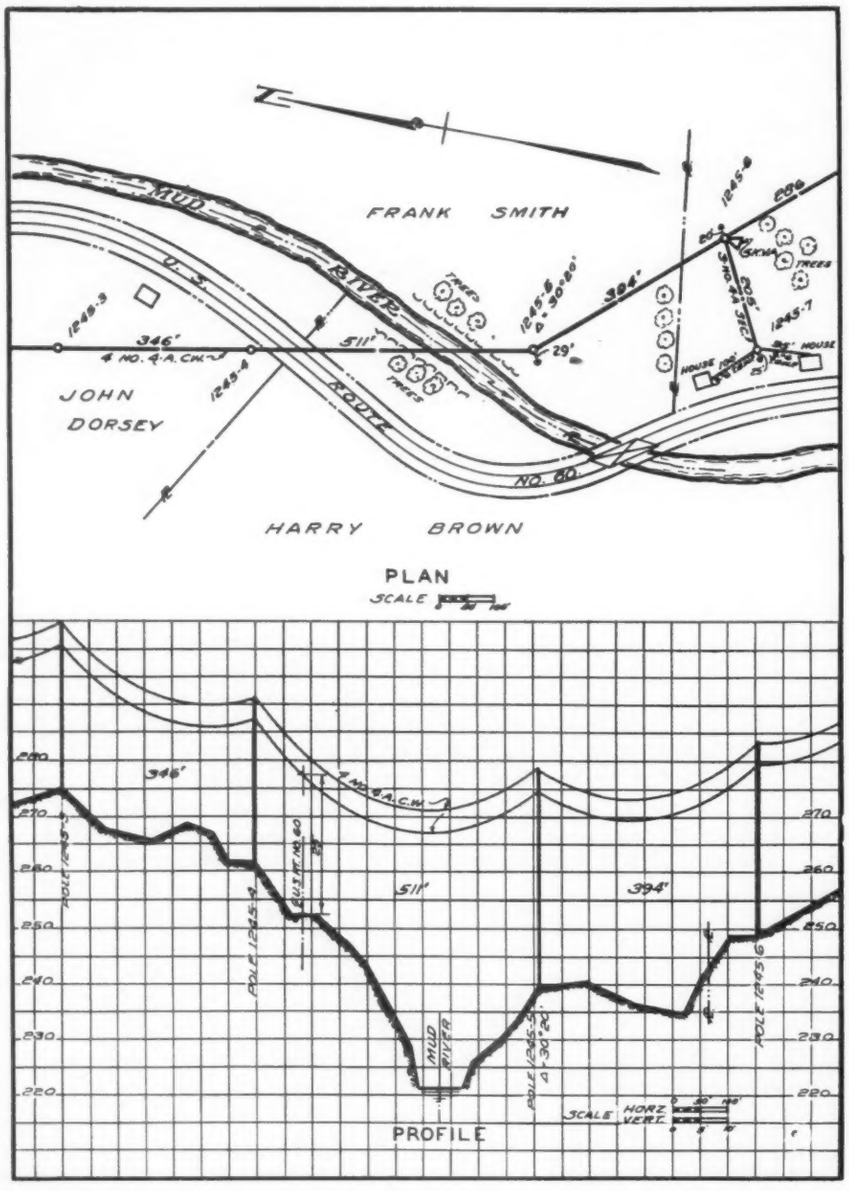

FIG. 1—PLAN AND PROFILE are drawn from stadia field notes. Note that slope distances from pole stake to anchor stake are indicated as 29 ft. from the angle pole 1245-5 and 20 ft. for the service pole 1245-6

UNIFORM STRENGTH of line is often a desirable objective in distribution design. The requisite class of pole to attain this objective, even with extremely uneven terrain, can be ascertained from a chart which requires only one computation for each particular configuration of conductors. Where a given configuration applies throughout the line, as is usually the case, this greatly simplifies the line design. This chart for determining ASA pole class is universal in that it can be used for any configuration, for any number or size of conductors. Each pole is engineered to give a uniform factor of safety which makes for safe and economical pole line construction as pole strength is applied where it is needed.

A companion pair of charts (one for "slope" or "lead" and the other for determining size and strength of guy) afford similar opportunity for carrying the design with transverse and longitudinal reinforcement.

Field Survey Predicated

Use of these design charts is predicated on the making of an engineering field survey. A stadia survey is satisfactory for the average distribution or transmission wood-pole line and from the notes of the survey the necessary data are obtained for the mechanical design of the line by use of the charts.

Plan and profile (Fig. 1) are plotted from the field notes, showing essential information for the spotting of the poles. Some pole locations are

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fixed by numerous factors as angle points, fence lines, service to customer, profile, etc. After the poles are spotted the span lengths are determined and also from the profile the requisite pole heights are determined.

If the line is to be designed to have uniform strength the class of pole for each location has to be computed. This is a long procedure if calculations are made for each pole. The "chart for determining A.S.A. pole class" (Fig. 2) is used for selecting the class of pole required for each location by making only one calculation for each conductor configuration used.

Pole Class

An example of the use of the chart will be given for a selected span length of 300 ft. on a line having three conductors in horizontal arrangement 34 ft. above ground plus a fourth (neutral) wire attached to the pole at 31.5 ft. height. All four conductors are No. 4A Copperweld, three-strand. Loading is 8 lb. wind on conductor with ½-in. ice, resulting in 0.860 lb. of wind load per foot of iced conductor.

The bending moment M is

$3 \times 0.860 \times 300 \times 34 = 26{,}316$ lb.-ft.
$1 \times 0.860 \times 300 \times 31.5 = 8{,}127$ lb.-ft.
Total bending moment 34,443 lb.-ft.

A straight edge from 300 on S-scale of Fig. 2 to 34,443 on M-scale intersects the K-scale at a certain point. To determine the pole class for any other actual or effective span length it is only necessary to rotate the straight edge about the established point on the K-scale.

Thus, for 35-ft. pine pole at 1245-4 in Fig. 1 it will be assumed that ultimate permissible fibre stress is 60 per cent and that the configuration is as given above. The effective span is 428.5 ft., the average of the adjoining spans of 346 and 511 ft.

Rotate the straight edge about the established point on K to 428.5 on S-scale. From the intersection with M-scale read horizontally to 60 per cent fibre-stress line under ASA class to find that a Class 3 pole is required.

Guy Slope Chart

Having chosen pole sizes, the next step is the determination of the size and strength of guys to be used on angle-poles, dead-ends, etc. The slope chart (Fig. 3) determines the angle made by the guy with the pole for all likely values of slope of ground between pole and guy. When lines are built along highway embankments or on natural hillsides it is difficult to ascertain and fix the "L over H" or "lead" of the anchor horizontally out from the pole for any given height of guy attachment at the pole. The slope chart enables use of "lead" measurement on the slope for the location of the anchor stake or anchor.

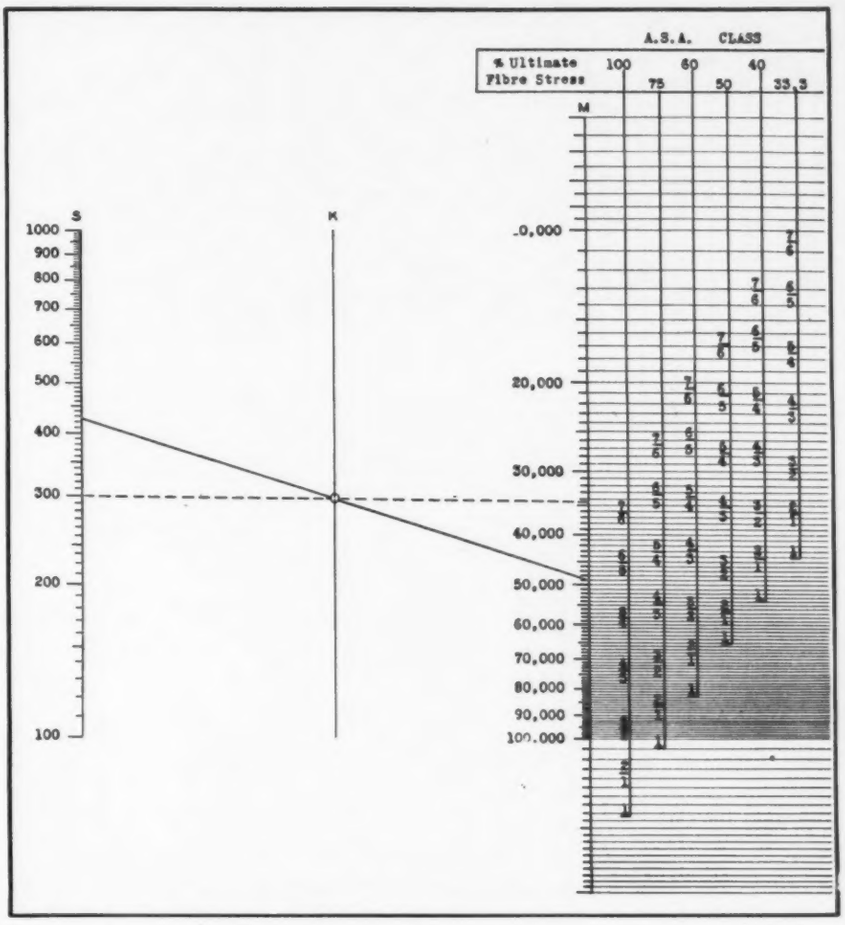

FIG 2—ASA POLE CLASS determined from conductor configuration and loading and span lengths
Based on ultimate fibre stress of 7400 lb. per square inch and heavy loading. Determine the bending moment in pounds-feet due to the transverse wind-load on the conductors for a selected span and on a 40-ft. pole set 6 ft. in the ground. Draw line from S-scale (span selected) to M-scale (computed bending moment). Where line intersects K-scale is the point about which to rotate straight edge in determining pole class for any span with given conductor configuration.

Size of Guy

It is assumed that the right-of-way and line surveys have fixed pole and anchor locations to take best advantage of terrain and the problem then is to take the data from the field survey notes, convert it into line angles and guy-lead angles. The slope chart and Table I facilitate these computations, as can be seen from the example accompanying Fig. 3.

With the line angle, conductor tensions and guy angle established, it is then possible to select the size of the guy required. This can be done from the guy chart (Fig. 4) in conjunction with Table II.

These are both appropriate in scope and scales for wide range of variation of the factors. Values can readily be determined for other types and sizes of conductors and guys than those shown in the charts and tables. Specific examples for a rural line are given in the caption for Fig. 4.

After pole sizes and guy details have been determined from Figs. 2 and 4 it is convenient to tabulate the data in logical order in a form which shows:

Structure — Pole number. Type. Height. Class. Kind. Back span. Angle. Remarks.

Under "Remarks" there would

GUYING CHART

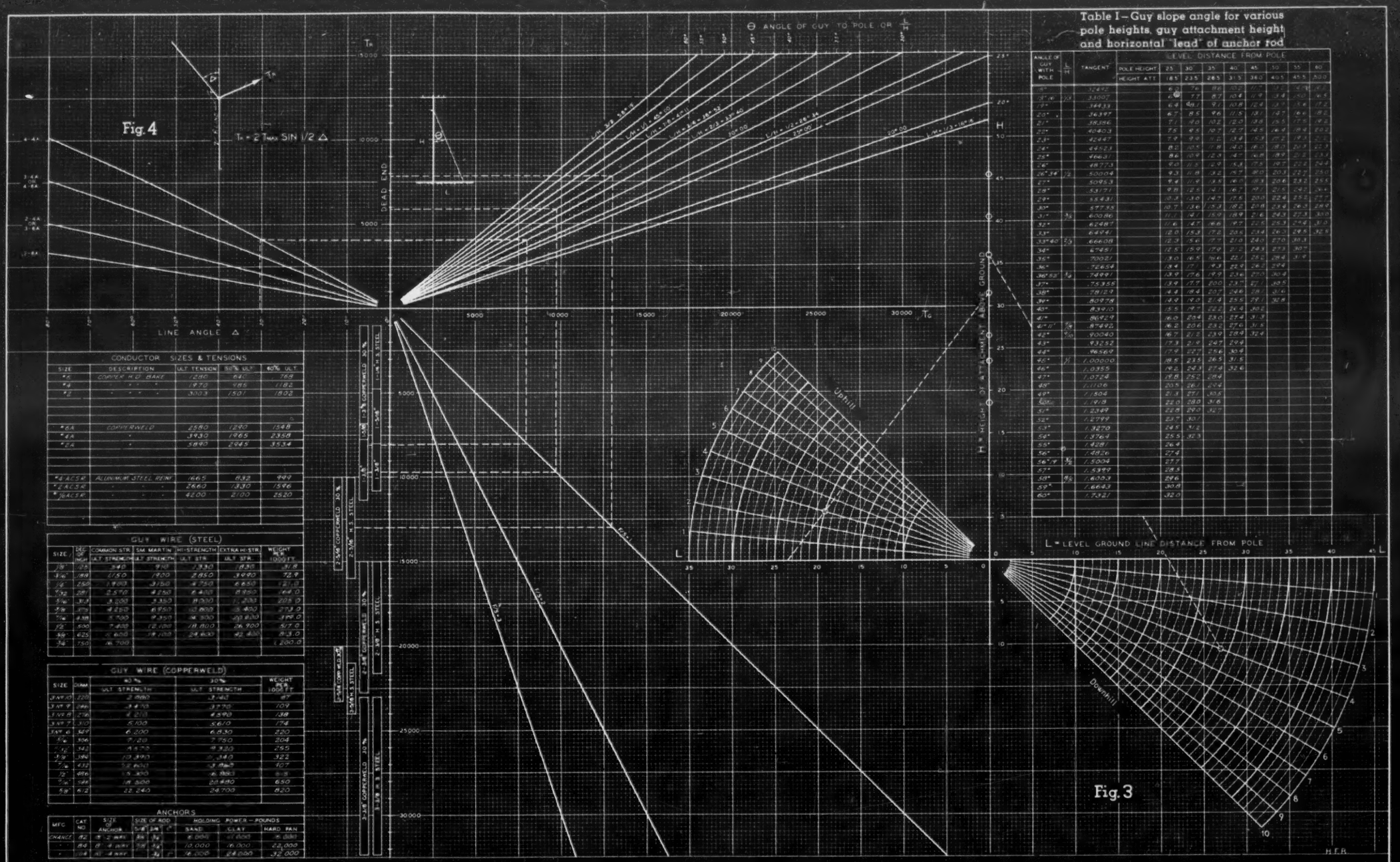

Table I – Guy slope angle for various pole heights, guy attachment height and horizontal "lead" of anchor rod

ANGLE OF GUY WITH POLE	TANGENT	LEVEL DISTANCE FROM POLE								
		POLE HEIGHT	25	30	35	40	45	50	55	60
		HEIGHT ATT.	18.5	23.5	28.5	31.5	34.0	40.5	45.5	50.0
5°	.0875		6.0	7.6	8.9	10.0	11.2	13.1	14.8	16.4
5° 43'	1/10	.1000	6.4	7.7	8.7	10.4	11.9	13.4	15.0	16.5
10°		.1433	6.4	8.1	9.6	10.8	12.1	13.7	15.4	17.2
20°		.3639	6.7	8.5	9.6	11.5	13.1	14.7	16.6	18.2
21°		.3836	7.1	9.0	10.2	12.1	13.8	15.7	17.5	19.2
22°		.4040	7.5	9.5	10.7	12.7	14.5	16.4	18.4	20.2
23°		.4245	7.9	9.9	11.2	13.4	15.3	17.2	19.3	21.2
24°		.4452	8.2	10.5	11.8	14.0	16.0	18.0	20.3	22.3
25°		.4663	8.6	10.9	12.3	14.7	16.8	18.9	21.2	23.2
26°		.4877	9.0	11.5	12.9	15.3	17.5	19.7	22.1	24.3
26° 34'	1/2	.5000	9.3	11.8	13.2	15.7	18.0	20.3	22.7	25.0
27°		.5093	9.4	11.9	13.5	16.0	18.3	20.6	23.2	25.5
28°		.5317	9.8	12.5	14.1	16.7	19.1	21.5	24.1	26.7
29°		.5543	10.3	13.0	14.7	17.5	20.0	22.4	25.2	27.8
30°		.5735	10.7	13.6	15.3	18.2	20.8	23.4	26.2	28.9
31°	3/5	.6008	11.1	14.1	15.9	18.9	21.6	24.3	27.3	30.0
32°		.6248	11.6	14.7	16.6	19.7	22.5	25.3	28.4	31.0
33°		.6494	12.0	15.3	17.2	20.5	23.4	26.3	29.5	32.5
33°40'	2/3	.6668	12.3	15.6	17.7	21.0	24.0	27.0	30.3	
34°		.6745	12.5	15.9	17.9	21.2	24.3	27.3	30.7	
35°		.7002	13.0	16.5	18.6	22.1	25.2	28.4	31.9	
36°		.7265	13.4	17.1	19.3	22.9	26.2	29.4		
36°52'	3/4	.7499	13.9	17.6	19.9	23.6	27.0	30.4		
37°		.7535	13.9	17.7	20.0	23.7	27.1	30.5		
38°		.7813	14.4	18.4	20.8	24.6	28.1	31.6		
39°		.8098	14.9	19.0	21.4	25.5	29.1	32.8		
40°		.8391	15.5	19.7	22.3	26.4	30.2			
41°		.8693	16.0	20.4	23.0	27.4	31.3			
41° 11'	7/8	.8792	16.2	20.6	23.2	27.6	31.5			
42°	9/10	.9040	16.7	21.3	23.9	28.4	32.4			
43°		.9325	17.3	21.9	24.7	29.4				
44°		.9657	17.9	22.7	25.6	30.4				
45°	1/1	1.0000	18.5	23.5	26.5	31.5				
46°		1.0355	19.2	24.3	27.4	32.6				
47°		1.0724	19.8	25.2	28.4					
48°		1.1106	20.5	26.1	29.4					
49°		1.1504	21.3	27.1	30.5					
50°		1.1918	22.0	28.0	31.6					
51°		1.2349	22.8	29.0	32.7					
52°		1.2799	23.7	30.1						
53°		1.3270	24.5	31.2						
54°		1.3764	25.5	32.3						
55°		1.4281	26.4							
56°		1.4826	27.4							
56°19'	3/2	1.5004	27.7							
57°		1.5399	28.5							
58°	8/5	1.6003	29.6							
59°		1.6643	30.8							
60°		1.7321	32.0							

CONDUCTOR SIZES & TENSIONS

SIZE	DESCRIPTION	ULT TENSION	50% ULT	60% ULT
#6	COPPER H.D. BARE	1280	640	768
#4	" "	1970	985	1182
#2	" " "	3003	1501	1802
#6A	COPPERWELD	2580	1290	1548
#4A	"	3930	1965	2358
#2A	"	5890	2945	3534
#4 ACSR	ALUMINUM STEEL REINF	1665	832	999
2 ACSR	" " "	2660	1330	1596
1/0 ACSR	" " "	4200	2100	2520

GUY WIRE (STEEL)

SIZE	DEC. OF INCH	COMMON STR. ULT STRENGTH	SIE. MARTIN ULT STRENGTH	HI-STRENGTH ULT STR.	EXTRA HI-STR. ULT STR.	WEIGHT LBS. 1000 FT.
1/8"	.125	940	990	1330	1835	31.8
5/32"	.188	1150	1900	2850	3990	72.9
1/4"	.250	1900	3150	4750	6650	127.0
5/32"	.281	2570	4250	6400	8950	164.0
5/16"	.313	3200	5350	8000	11,200	205.0
3/8"	.375	4250	6950	10,600	15,400	273.0
7/16"	.438	5700	9350	14,300	20,800	370.0
1/2"	.500	7,600	12,100	18,800	26,900	517.0
9/16"	.625	9,600	15,100	24,800	42,400	813.0
5/8"	.750	16,700				1,280.0

GUY WIRE (COPPERWELD)

SIZE	DIAM	40% ULT STRENGTH	30% ULT STRENGTH	WEIGHT LBS. 1000 FT.
3 W# 10	.135	2,980	2,460	87
3 W# 9	.146	3,470	3,270	109
3 W# 8	.216	4,210	4,590	138
3 W# 7	.310	5,100	5,610	174
3 W# 6	.349	6,200	6,830	220
5/16	.306	7,120	7,750	204
7/16	.342	9,570	9,320	255
3/8	.384	10,390	11,340	322
7/16	.413	13,600	13,800	407
1/2	.496	15,300	16,800	515
9/16	.546	18,500	20,490	650
5/8	.612	22,240	24,700	820

ANCHORS

MFG	CAT NO	SIZE ANCHOR	SIZE OF ROD DIA	SIZE OF ROD SQ	HOLDING POWER – POUNDS SAND	CLAY	HARD PAN
CHANCE	A2	8" 2 WAY	5/8	5/8	8,000	not rated	not rated
"	A4	8" 4 WAY	5/8	5/8	10,000	16,000	22,000
"	D8	10" 4 WAY		3/4	14,000	24,000	32,000

Table II – Conductor, Anchor and Guy Wire Data

NOTE:
VALUES IN ABOVE CHART TAKEN FROM MANUFACTURERS TABLES

H.F.R.

properly appear some such notations as follows for poles 1245-5, 1245-6, 1247-7: "Install ⅜-in. Copperweld angle guy to 8-in., four-way anchor." In addition there would be the notation "Install 5-kva. transformer" on pole 1245-6.

This would clinch and record the results of the foregoing computations.

Incidentally, these two charts and two tables can readily be arranged on a single 10x16-in. cross-section area.

FIG 3—SLOPE CHART gives horizontal equivalent of guy "lead" measured on slope up or down from pole

Example—Find angle of guy with 45-ft. pole (guy attached at 36 ft.) and anchored 29 ft. down hill from pole on slope of 4 ft. in 10. Place straight edge (1) at intersection of 29-ft. down-hill arc with 4-ft.-in-10 slope line and (2) at 36 ft. on H-scale. The straight edge intersects the horizontal at 20.8 ft. From Table I it is determined that 20.8 ft. horizontal lead with 36-ft. attachment height on a 45-ft. pole signifies a 30-deg. angle for the guy. On the left is shown a determination for 3-ft. slope, 20-ft. "lead" line on slope. Here the straight edge is to be extended to the base line to determine the equivalent horizontal lead.

FIG 4—GUY SIZE for given line angle and pull and for particular guy slope angle (or lead)

Example of Angle Guy—To determine size of guy for holding 45-ft. pole on line angle of 30 deg. 20 ft. with guy slope angle of 30 deg. and four No. 4A Copperweld conductors loaded to tension of 1,965 lb.

Chart Solution—Start at left side of guy chart at line angle of 30 deg. 20 ft. and proceed vertically to line representing four No. 4A conductors, thence horizontally to line indicating 30 deg. angle of guy with pole; thence vertically to "factor of safety" line (here F.S.=1), thence horizontally to vertical axis to find size of required guy to be one ⅜-in. H.S. Copperweld.

(The conductor curves, here drawn only for Copperweld conductors for rural use, are based on the formula $T_r = 2T_{max} \sin \frac{1}{2}\Delta$ and can readily be plotted for other conductors by using proper tension values.)

Example of Dead-end Guy—To determine size of guy required for three No. 4A Copperweld conductors dead-ending at 40-ft. pole. Conductors strung for maximum tension of 50 per cent of ultimate under heavy loading conditions, 1,965 lb. each. Total 5,895 lb. Guy makes angle with pole $L/H = \frac{3}{4}$.

Chart Solution—Enter chart at 5,895 on vertical scale marked "dead-end." Thence horizontally to L/H line marked ¾, thence vertically to $FS = 1$ and horizontally to find required guy again to be one ⅜-in. H.S. Copperweld.

In a third example shown on the chart it is found that four No. 4A conductors under similar conditions would require two 5/16-in. H.S. steel guys.

Vibration of Frame Reduced on Waterside Generator

[*Continued from page 31*]

the original motion is required, and it appears that a reduction of this amount is desired. Increasing the frame rigidity is of no value either, because the normal frame structure is approximately one-seventh to one-tenth as rigid as a stator core; therefore, no worth-while increase in the combined stator and frame rigidity is obtained in this manner.

The vibratory motion of the stator is not large even in the largest two-pole generators, and it is not harmful to the core itself, provided the laminations are tightly bound together and to the frame, so that they act with the frame as an elastic ring in bending. The core and frame assembly, of course, must have a resonant frequency of well over 120 cycles for the kind of vibration in question. If the stator is built to meet these requirements and is isolated from the outer frame structure, so that no vibratory motion is transmitted to the foundation, a completely satisfactory design will be obtained.

Flexible Mounting

The motions of the various parts of the stator core, when it is distorted into an elliptical shape and this ellipse caused to rotate, results in each point on the neutral axis of the ring's cross-section moving in an elliptical orbit. The major axis of this orbit lies along a radial line through the point in question. Amplitude of the motion along the minor axis is one-half that along the major axis. For points inside the neutral axis of the ring section the amplitude of the motion along the minor axis is greater than one-half that of the major axis and approaches a value more nearly equal to it. For points beyond the neutral axis the tangential motion becomes less until at a distance equal to one-third the radius to the neutral axis tangential motion is substantially zero.

This fact allows the use of a satisfactory flexible mounting for the stator core. The point of zero tangential motion is located just outside the core section. A series of supports having flexibility in a radial direction only are attached to the core at these points, allowing the core to distort in response to the forces acting on it, while at the same time rigidly supporting it in place in the outer frame. This type of mounting and the experimental work carried on to prove its feasibility have been described.*

Frame Vibration Small

This preliminary experimental work was followed by the manufacture of a 10,000-kw. experimental generator to prove the operating feasibility of the flexible mounting. Test results on this experimental generator were so satisfactory that it was decided to use the new mounting in the 81,250-kva. generator for the Consolidated Edison Company. The inner frame of this generator is made in two sections and provision is made at the splits, by the use of thin filling strips, for the inner frame to be clamped tightly around the core after the core laminations are stacked and clamped together. The laminations are held tightly clamped by longitudinal bolts through the core. Clamping the inner frame to the core in this manner insures that the two will distort together under all magnetic pull action and cause no trouble from wear on the contact points between them.

During witness test on factory foundations, the performance of this generator was outstanding. Test results show an interesting comparison of the core and frame foot vibration with the generator operating at full speed. Readings are shown for conditions of no field excitation and for conditions corresponding to full load operation.

	No Field in.	Full Field in.
Core Vibration	0.0002	0.0015
Frame Foot Vibration	0.00015	0.0002

The results indicate that although the core vibration increased over seven times when the field was excited, the frame foot vibration increased only 30 per cent. The overall noise level did not perceptibly change, although a very slight increase in the 120 cycle component of the noise could be detected. These test results are definite proof of the new design's success.

Although measured values of the vibration will be affected by the characteristics of the foundation used on

[*Continued on page 98*]

*Presented in a paper by Messrs. C. M. Laffoon and B. A. Rose of the Westinghouse Electric & Manufacturing Company at the A.I.E.E. spring convention in 1938.

Maximum Availability Aim of Switch-House Design—I

Ground fault bus, compact two-part switchgear, interlocks, special ventilation and careful structural layout contribute to the emergency reliability of San Diego Station B switch house extension

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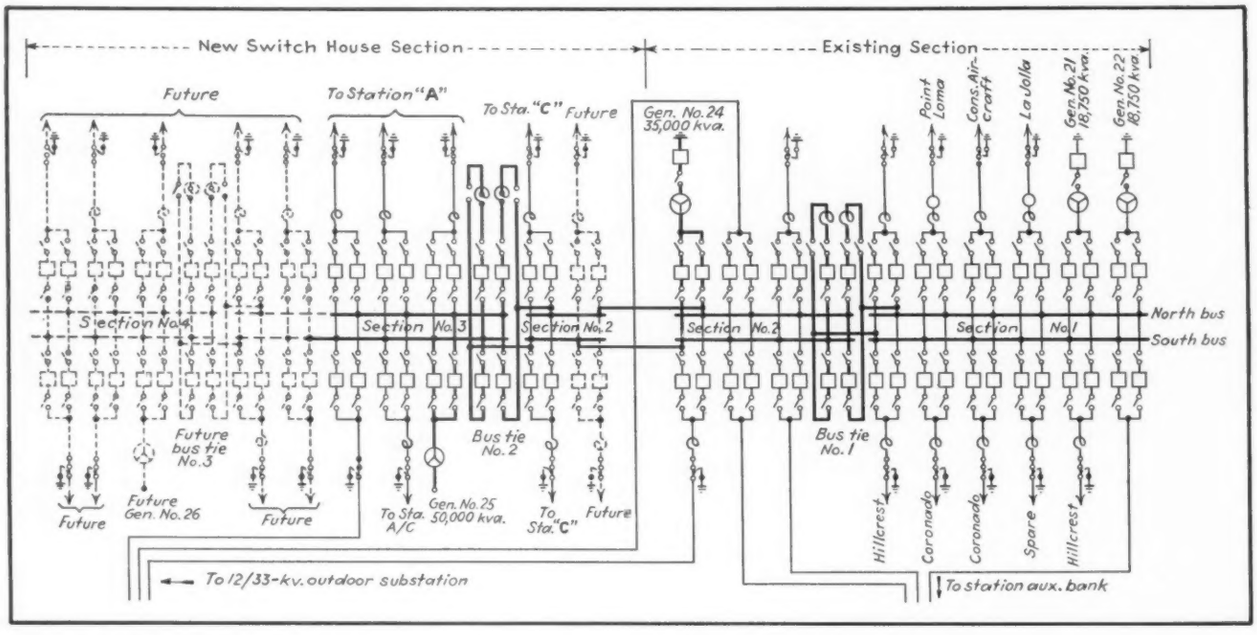


SWITCH HOUSE EXTENSION adds 20 cubicles to station house with space for 24 additional; increases feeders approximately 50 per cent

INCREASES IN LOAD subsequent to installation in 1938 of a 35,000-kw. turbo-generator at Station B, San Diego Gas & Electric Company's only steam-electric plant—capacity 100,000 kw.—necessitated expansion of the station switch house: (1) to provide additional feeders and (2) to prepare for transfer of a number of feeders in the oldest section of the station, which is to be abandoned.

The fundamental design of the switch house was already largely determined by the operating arrangement of the existing portion of the switch house when the project was undertaken early in 1939. The problem remaining for designers was that of refining the design to conform to advances in the art since 1928 when the original switch house was planned.

In large part, the problem was one of fitting modern high-capacity, metal-inclosed switchgear into restricted space, incorporating fault bus protection, provision of interlocking on switchgear and arrangement of station ventilation to give maximum availability under emergency conditions imposed by electrical failures, fire or explosion.

Eight principles considered fundamental to modern switch-house design were given major consideration in the design. These were that:

1. Provision of some form of bus fault relay protection is absolutely necessary to clear bus faults promptly.

2. Interlocking of electrical switchgear is desirable; extent of its use being dependent on operating requirements.

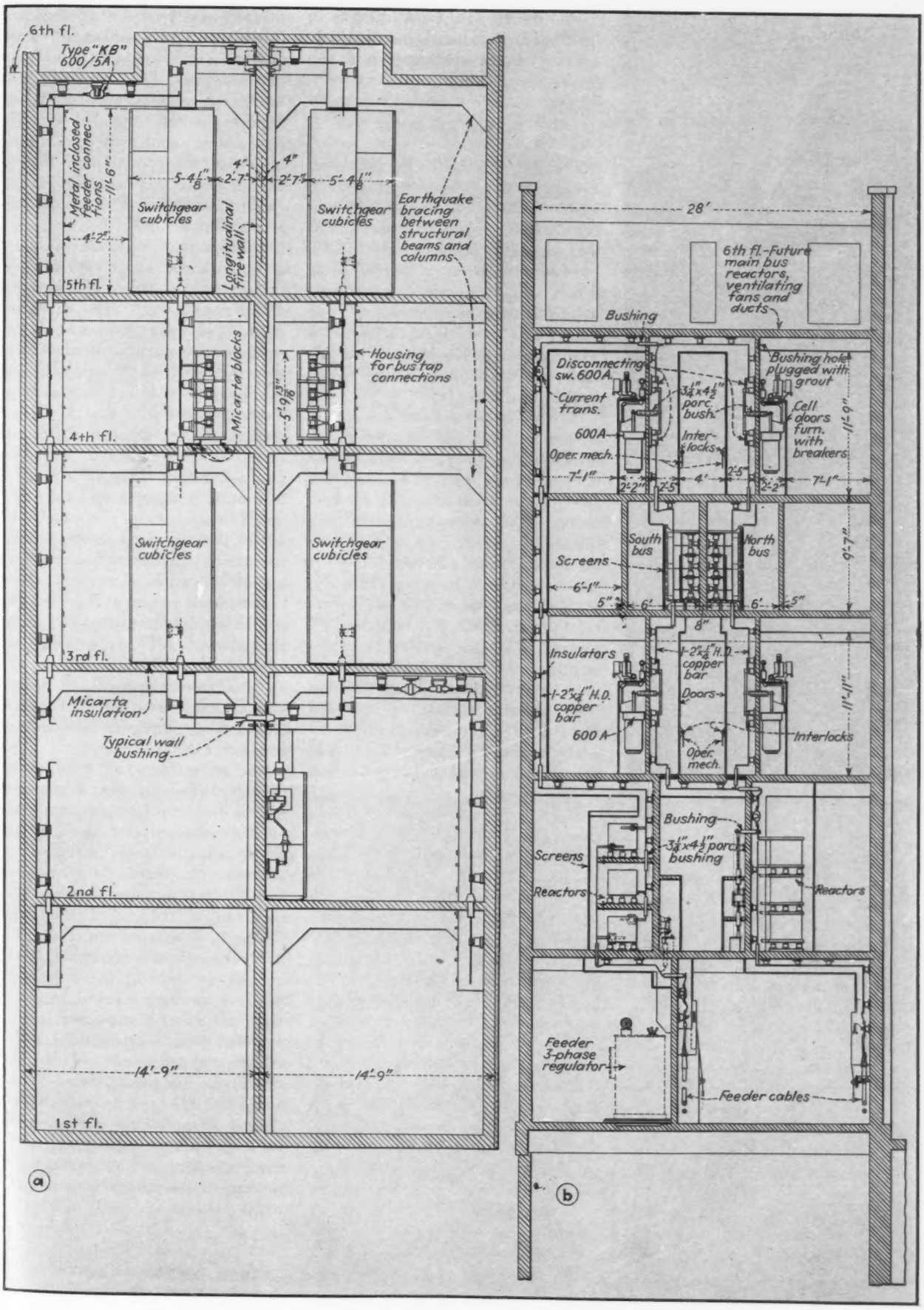
3. Permanent openings for ventilation should not be permitted in floors or walls between rooms containing electrical equipment or connections.

4. No openings through which conductors pass from floor to floor or room to room should be permitted. Bushings should be used for this purpose and should be reasonably gastight.

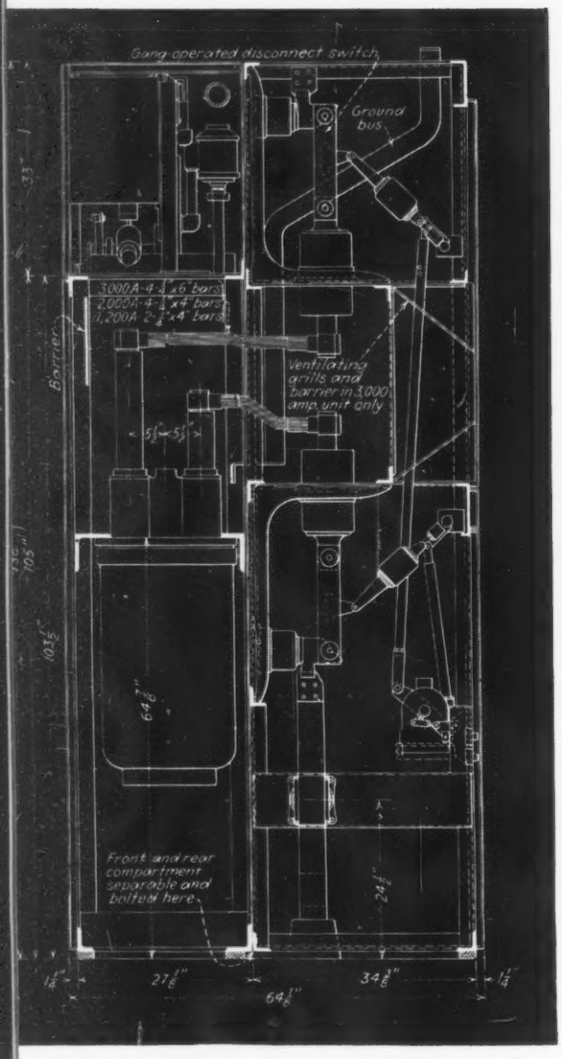
5. A separate ventilation connection should be provided for each room.

6. Provision should be made for

*Chief electrical engineer. †Electrical engineer.



LOCATE FIRE WALLS to confine fire or explosion damage to one bus section — (a) center fire wall in new section completely separates duplicate buses, (b) section of old building



COMPACT two-part cubicles fit 1,000,000-kva. breakers into limited space

partial selective shutting down of normal ventilating equipment in the event of fire (preferably through automatic means) and for closing openings so as to stop ingress of fresh oxygen which will aggravate the fire. Where ventilating duct system contains openings or dampers into which smoke might seep when the ventilating system is shut down, these openings or dampers should be arranged to close off, possibly automatically through operation of bus protective schemes, if feasible.

7. Special study should be given installation of separate equipment to remove smoke and a reliable source of power be provided to operate such equipment during plant disturbance.

8. Water and/or CO_2 headers should be provided with means of inserting nozzles through wall openings into rooms which may be on fire.

How these principles were applied to the design of the new section of the Station B switch house, and subsequently to the existing portion, will be discussed in this paper.

Existing Conditions

Preliminary plans called for an extension to the existing switch house which would nearly double its switching capacity. The existing section of the building houses forty 12-kv. breaker compartments serving some fifteen outgoing feeders. In the new extension it was planned to add twenty new cubicles supplying seven additional 12-kv. feeders and provide space for 24 more cubicles and eleven feeders in the future.

As can be seen from the station wiring diagram, the existing switch house section contained duplicate 12-kv. main buses, each in two sections. Bus sections were arranged for connection either through a bus-tie (sectionalizing) breaker or through bus-tie reactors and breakers. Feeders can be connected to either of the duplicate buses through selector breakers by use of the conventional "T" connection. This general arrangement was adhered to in the new section. The second or stub bus section in the existing building was extended and a third section added to both the north and south buses. Space was provided for further bus extension as load required.

Station B occupies a city block surrounded on three sides by city streets and on the fourth by the Santa Fe Railroad. In consequence, the switch house is a tall, narrow, six-story structure. The existing section is 85 ft. long and 30 ft. wide. The new extension brought the total length of the structure to approximately 170 ft. In the existing section the buses were allocated to the fourth floor, with feeder and bus-tie breakers located on the floors immediately above and below. Connections from switchgear on the third and fifth floors passed to feeder reactors on the second, regulators on the first and outgoing cables in the basement.

This general allocation of equipment was followed in the design of the extension, with the principal departures in structural design being confined to the location of fire walls.

Location of fire walls in the extension was largely determined by the selection of any section of either bus as the "unit of destruction." Under the philosophy of design, fire walls in the extension were located so that any bus section could be lost by fire, explosion or other disaster without the fire communicating to equipment other than that associated with that bus section, and without seriously impairing the operation of the rest of the station. Equipment in each "unit of destruction" was designed for minimum cost.

In accordance with this principle a longitudinal wall was extended through the center of the building, dividing it in two. The north and south buses and all switchgear and equipment electrically associated with them were located on opposite sides of this center wall. This arrangement contrasts with that in the old section, where, although a fire wall exists between the north and south bus, connections from both buses to disconnect compartments on the third and fifth floors enter the same room, although walls do separate the disconnect compartments from their associated circuit breakers.

The single center wall in the new section permitted a more symmetrical arrangement of equipment and allowed bus taps to be led straight up and down to associated switchgear compartments without jogs and offsets that complicate buswork and consume valuable space.

The system of ventilation for the entire switch house, details of which will be discussed later, influenced the method of connecting the new and old building sections. Fresh air is brought into the building through vertical ducts at opposite ends of the switch house, the general plan being for air to flow from the roof downward through the stairwells at the ends of the building, thence horizontally to an open central vestibule shaft extending from basement to roof and entirely across the building at the point where the old and new building sections abut. Access from the old building to the new is over open gratings across the vestibule shaft at each floor level. Exhaust fans, which draw air through the building, are located above the shaft at the sixth floor level.

Switchgear

One of the outstanding features of the switch-house extension is the compact, completely metal-inclosed switchgear compartment design developed for this installation by the

manufacturers from plans submitted by the engineers of the Public Utility Engineering & Service Corporation. Design of these compartments was complicated by the narrowness of the switching galleries, low headroom, the location of earthquake bracing between structural beams and columns, and the fact that breakers of relatively high interrupting capacity (1,000,000 kva.) were necessary to meet the eventuality of a new station being built in the San Diego area to be interconnected with Station B, or of transmission line interconnection with other large neighboring electrical systems.

Switchgear, buses and bus runs were constructed for operating voltage of 15 kv., but were required to withstand 54 kv., 60 cycles for one minute.

Three Breaker Sizes

Breakers selected for this installation were of three sizes—fourteen were 1,200 amp., four 2,000 amp. and two 3,000 amp. All had an interrupting rating of 1,000,000 kva. and were type 0-22-B, 15 kv., oil-filled, Deïon grid units, solenoid operated. At the time that the installation was made these breakers were the only ones available in 1,000,000 kva. ratings that would fit the space available. Modern oil-less breakers of this interrupting capacity were not yet on the market.

The switchgear cubicles housing both disconnect switches and breakers are all the same dimensions, regardless of breaker rating. Cubicle design was limited by the dimensions of the fifth floor switching gallery, which was 13 ft. 8 in. wide and 13 ft. 1⅞ in. high, including space for two operating aisles, one on each side of the cubicles, and space for circuit connection housings. This demanded a low, "thin" cubicle to provide necessary operating space. In the final design a two-part cubicle 5 ft. 4⅛ in. from front to back and 11 ft. 6 in. high was developed. These dimensions left a 4-ft. 2-in. operating aisle on the breaker side of the cubicles and a 2-ft. 7-in. aisle on the disconnect compartment side.

More than any other one factor, the arrangement of the bushings, leading from the breaker compartment to the disconnect compartment, contributed to the compact cubicle design. Connections from the breaker compartment to the disconnect compartment pass through an opening in the back of the breaker compartment into a square box-like compartment in the disconnect portion of the cubicle, which is closed on five sides. Here, vertical bushings carry the leads through the housing to the disconnect switches. These bushings form the bottom and top post respectively of the upper and lower disconnect switches. By eliminating one switch support this arrangement considerably reduced the over-all height of the disconnect compartment and so of the cubicle proper.

By designing the cubicles in two self-contained compartments, one for the breaker and the other for disconnect switches, a double thickness of metal was secured between compartments and permitted the compartments to be handled in two sections and with greater ease. It also allowed the 5-ft. 4⅛-in. wide cubicle to be moved through the 4-ft. 2-in. aisle and considerably reduced weight to be lifted.

Each of the cubicles is mounted on 1-in. micarta blocks to isolate it from the building structure and permit its connection to the fault ground bus system. The holding-down bolts are insulated from the base of the cubicle.

The breakers are solenoid operated. The six single-pole disconnect switches are operated simultaneously in gangs of three each by a removable crank handle through a gear box.

Interlocks Amplified

Although operating mechanism of the breakers and disconnect switches is co-ordinated on the interlock system, a special lock has been provided on the doors of the disconnect compartment, which is not a part of this system. Under most operating conditions either one or the other of the incoming disconnect switch posts will be energized, either by back-feed from the feeder or from the energized bus, even though the switches are open. If the disconnect compartment door was interlocked it was felt that operators might enter and contact these energized switch parts, reasoning that if they could open the door with an interlock key everything in the compartment was dead. With the special key arrangement, operators wishing to open the disconnect compartment door must file a report in writing requesting the compartment key and stating their reasons.

Discussion of the buses, floor and wall bushings, feeder grounding, station ventilation, fault bus protection and interlock system will be given in a subsequent installment.

SAN DIEGO STATION B occupies a city block. The blank wall facing the camera is north wall of the expanded switch house

Employee Relations Problems Dissolved by Discussion

Free and unhampered talking over of problems by the foremen and other supervisors crystallizes opinions and suggestions that are then brought to the consideration of the management

JAMES S. WARREN, Pennsylvania Electric Company

MISUNDERSTANDINGS cause by far the greater number of employee relations problems. Laws are frequently misunderstood by those they are designed to protect, so also are company policies laid down for conduct of the business. In the experience of the Pennsylvania Electric Company it is estimated that 85 per cent of all employee problems are caused by such misunderstandings. This conclusion derives from analysis of the workings of a plan by which for nearly two years the company has sought to bring to employees clear and definite understanding of laws and business policies.

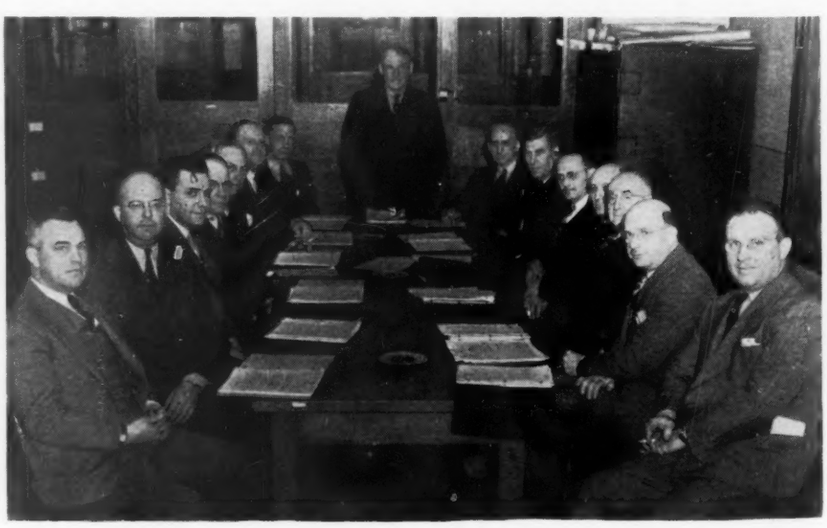
Organization

Foundation of the plan is the organization of all supervisors, from foremen to department heads, into discussion groups. Groups are kept small, twelve to fourteen members each; only men of equal rank and doing similar work are included in a group; no person of superior authority is ever present at a group meeting; all discussion is confidential; reference or recommendation concerning any problem represents the consensus of the group concerned. Thus any action of a group is the result of free, uninhibited consideration by equals of a matter with which all members of the group are familiar. In the Pennsylvania Electric Company there are eleven of these groups and the 160 or so men they include are those to whom employees turn first when questions and problems arise.

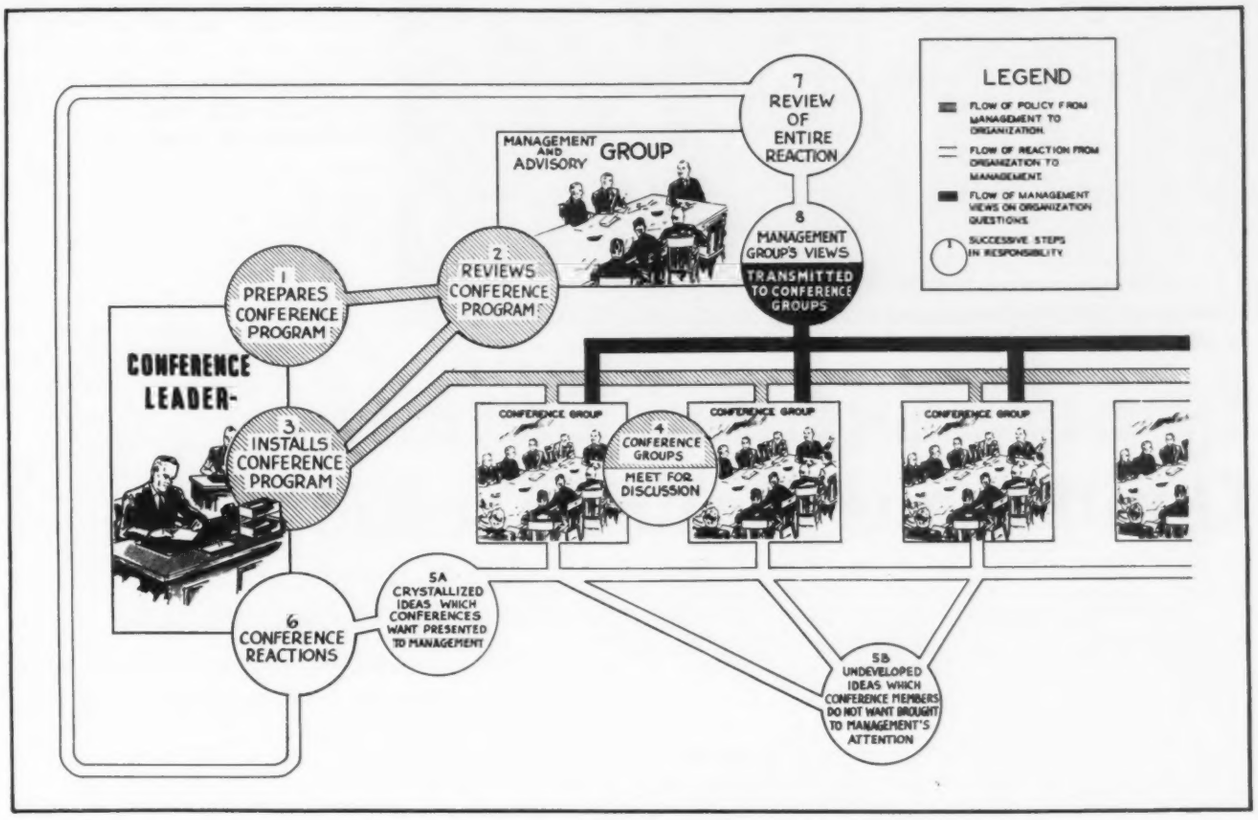
Outlet for the conclusions of these groups is a conference leader who organizes the group meetings, sends out notices of meetings, keeps minutes and other records and leads and directs discussions. About 75 per cent of the problems discussed in the group meetings are settled without going any further; that is, the combined knowledge of the twelve or so men in a group is sufficient to clarify and settle many matters that otherwise would require ruling by management. But if a problem must be carried further it is the duty of the conference leader to bring it before the management and advisory group, which consists of six members, who are, in the Pennsylvania Electric set-up, the operating manager, two division managers, the personnel director, the treasurer and the auditor.

After due consideration of the matter referred to it this group makes a recommendation, which is passed on to the president of the company. This recommendation may involve only the clarification of some policy or interpretation of a rule, or it may mean a change in policy. For instance, one of the divisions was experiencing difficulty in collecting bills which are prorated for part-time meter reading periods. Apparently two divisions were interpreting the rules differently. The conference group, composed of men from both divisions, referred the matter to management. The leader brought the problem before the advisory group, which in turn recommended favorably to the president that a general letter be sent out clarifying the instructions. This recommendation was authorized by the president and carried out by the auditor.

The participation of department managers in this advisory group con-



A CONFERENCE GROUP in session


LEGEND
FLOW OF POLICY FROM MANAGEMENT TO ORGANIZATION
FLOW OF REACTION FROM ORGANIZATION TO MANAGEMENT
FLOW OF MANAGEMENT VIEWS ON ORGANIZATION QUESTIONS
SUCCESSIVE STEPS IN RESPONSIBILITY
7 REVIEW OF ENTIRE REACTION
MANAGEMENT AND ADVISORY GROUP
8 MANAGEMENT GROUP'S VIEWS TRANSMITTED TO CONFERENCE GROUPS
1 PREPARES CONFERENCE PROGRAM
2 REVIEWS CONFERENCE PROGRAM
CONFERENCE LEADER-
3 INSTALLS CONFERENCE PROGRAM
CONFERENCE GROUP
4 CONFERENCE GROUPS MEET FOR DISCUSSION
CONFERENCE GROUP
CONFERENCE GROUP
5A CRYSTALLIZED IDEAS WHICH CONFERENCES WANT PRESENTED TO MANAGEMENT
6 CONFERENCE REACTIONS
5B UNDEVELOPED IDEAS WHICH CONFERENCE MEMBERS DO NOT WANT BROUGHT TO MANAGEMENT'S ATTENTION

ORGANIZATION and flow chart of employee relations plan

serves time and, in addition, acquaints the managers with the various problems and difficulties which supervisors are experiencing. At the same time this gives them an opportunity to suggest ways in which these problems may be solved.

Up for Decision

In this manner executive consideration is given to the matters which the conference groups decide are worthy of such consideration. Following the recommendations of the advisory group the president may adopt one of several methods in disposing of them. He may assign some one to investigate the practicability of a recommendation and report back at the next meeting; he may take the matter under personal consideration; he may ask the department head involved in the problem to put a recommendation in immediate operation, or he may make an unfavorable decision. In any case, the answer is given to the leader of the groups, who, in turn, reports the president's decision to the interested group at the next conference meeting.

Subjects for discussion at the meetings of the eleven conference groups are introduced by a letter from the president of the company addressed individually to each group member sufficiently in advance of the particular meeting so that each member may prepare himself for informed discussion. Usually the subject is a general one, such as "The Methods of Leadership," which will allow a wide range of specific problems and instances to be brought up from the experience and knowledge of the men at the conference meeting. The subject is really intended as a means to evoke discussion of definite matters in the minds of employees. For instance, the subject of "The Responsibility of the Supervisor" was scheduled for discussion. From this came the recommendation of one of the conference groups that periodical physical examinations of employees be made at company expense.

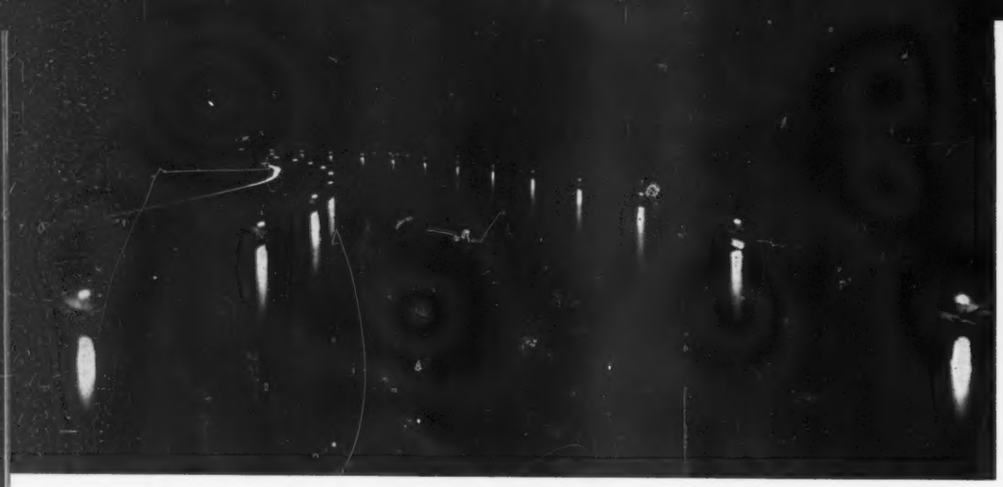
The conference leader made note of the action and brought the recommendation before the advisory group the following week. On favorable action of this group, the recommendation was passed to the president, who designated the personnel director to investigate the cost and practicability of the proposal. Upon final approval, the leader was authorized to report the results of the decision back to the originating group at the next monthly meeting.

Reaction from our experience with this conference plan has been very favorable. While it is difficult actually to measure the improvement in our organization, we feel sure that much has been accomplished. This is especially noticeable in the better fellowship existing between employees and the improved relationship between departments.

Solutions by Discussion

As before stated, we find that most of the problems and difficulties disturbing supervisors are generally due to misunderstandings of the company's policies or a misinterpretation of instructions. We also find the best way to "iron out" these misunderstandings is to bring together for discussion supervisors of the same rank, having similar tasks, such as this plan provides. It is obvious that twelve men "pooling" their ideas will find the solution to a problem where one might have difficulty in doing so.

PUBLIC RELATIONS SERIES



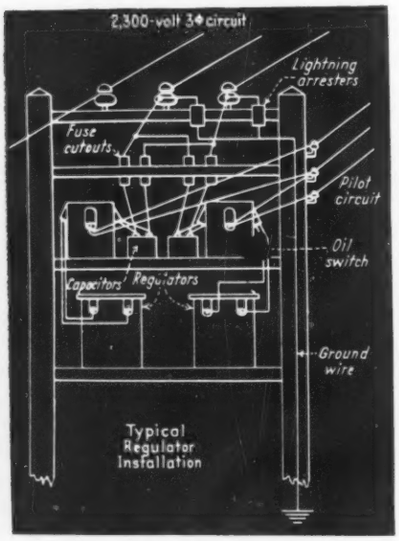
EVENING VIEW of canal showing high visibility provided by sodium units

Sodium Lighting Permits Continuous Canal Traffic

Cape Cod waterway is equipped to overcome delays caused by fog — Lamp circuits are arranged for economical operation

ROBERT B. ELY, Illuminating Engineer, Wollaston, Mass.

PRIOR TO 1936 the Cape Cod Canal was a one-way channel 7.7 miles long, connecting Massachusetts Bay at Sagamore with Buzzards Bay at Bourne. The canal width has since been increased to 500 ft. It shortens the route from New York to Boston by 65 miles, as compared with the more exposed route around Cape Cod, and is one of the most important waterways in the East. Two highway bridges about 3 miles apart cross the canal, and near the Buzzards Bay end is a railroad bridge with a 540-ft. vertical-lift span, the largest span of its type in the world. Free movement of traffic through the canal at all times, regardless of fog or other conditions, is an objective which cannot be overestimated for both commercial purposes and national defense. The part played by electric lighting in attaining this status of operation is of vital importance.



LAYOUT of typical regulator installation for sodium lighting circuit

In early spring and autumn the locality is subject to fogs of varying degree and ground haze or vapor. At times in the past all traffic through the canal has had to be halted at the approaches to wait for the fog to clear. In order to eliminate the delays to navigation it was decided to light the canal and make it navigable under adverse weather conditions. Several types of light sources were demonstrated and observations made. Finally it was decided to adopt sodium-vapor lamps as they have particular advantages for the application.

The preliminary investigation of the various light sources included incandescent lamps, mercury lamps, neon and sodium-vapor lamps. H. P. Dunbar, engineer in charge, and his assistants made the tests, investigations and visual observations on the various light sources to determine their effectiveness under all weather conditions. Captains of the steamships using the canal were requested to observe and report on the various light sources and express their opinion as to visibility. The tests were of a practical nature and intensity of illumination on the banks was unimportant as sufficient spill light would provide adequate illumination for the service roadways.

The lighting is of the indicating marker type to enable navigators to determine the locations of bends in the canal and to approximate their positions within the canal by the lights on each side of the vessel in thick weather.

Sodium Adopted

Comments of the observers contributed to the final decision to adopt sodium lighting. Reasonable objections to other sources were offered. The incandescent lamp, backed with a reflector to provide adequate beam

candle-power during a fog, was too glaring during clear weather. Mercury lamps of low wattage would require a heating element in extremely cold weather to start them initially and to maintain their light output; These also gave objectional glare. The need for a reactor or transformer for each unit was also an undesirable feature. The neon light was not sufficiently concentrated to become visible in a heavy fog or vapor and it likewise required auxiliary equipment that was not desired.

The sodium lamp gave sufficient light output to meet the lighting requirements during average fog or vapor that might prevail. It also was adaptable to the straight 6.6-amp. series circuit. It has a distinctive color and is not likely to be confused with other exterior lights. Again, it is the most efficient light source available and requires a minimum of auxiliary parts, which tends to keep the maintenance costs low.

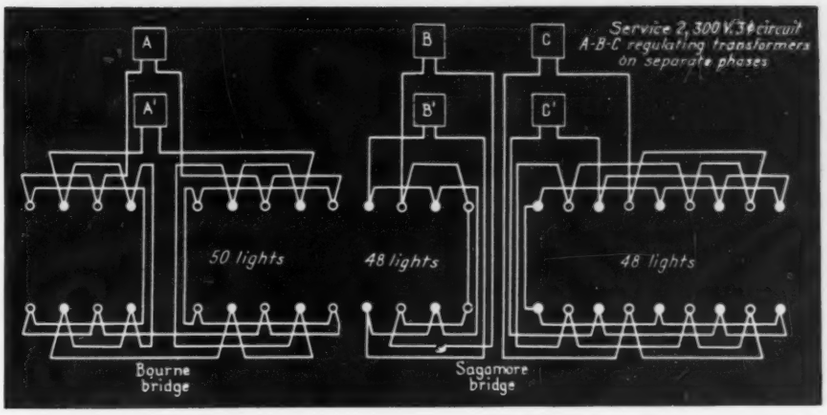
Pilot Control

On each side of the canal there is a service roadway and the luminaires are located so that adequate illumination is provided here.

During thick weather vessels approaching the canal readily distinguish the location of the canal at a distance because the haze and light fogs reflect the yellow glow of the sodium lights. This is also an aid to air navigation. When heavy fogs prevail more light sources are required than in clear weather. Provision is made to permit the operation of half the lights during clear weather and all the lights in foggy weather.

Circuits are sectionalized so that in the event of failure of one circuit half the lights will still be in operation on each side of the canal. The control is manually operated from the supplying substation by a three-wire pilot circuit which operates the high-voltage switches at each transformer bank. In order to compensate for the voltage drop on the pilot circuit a small transformer steps up the potential to 520 volts. The control coils on the oil switches are designed to operate at 260 volts. The wiring diagram shows the arrangement of the circuits. Service is 2,300 volts, 60 cycles, three phase, supplied by the Cape & Vineyard Electric Company.

The 2,300-volt lines run from one end of the canal to the other end to supply control houses at Wings Neck and Sagamore. Service for the bridges and the regulator banks are supplied from this line. The complete installation for the canal lighting consists of 146 10,000-lumen sodium lamps. The luminaires are spaced 500 ft. apart in parallel arrangement. In clear weather half the lights are on. This provides a light source on each bank every 1,000 ft. The circuits are used alternately so that the average burning of all the lamps will be equalized.



SCHEME of lighting circuit sectionalization; half of the units can be cut out in fair weather to save running costs

Circuits are sectionalized in three divisions, consisting of 50 48-48 lamps to each section of the canal. This arrangement was planned because at times the ground vapor or fog will be dense in part of the canal only, and when this condition exists that section affected can be illuminated by the manual control on the oil switches. The sketch illustrates the typical arrangement of a regulator bank. There are three banks of this character.

Capacitors are employed to improve the power factor; lightning arresters and fuse cutouts provide desired protection at the regulators. The luminaires on the canal banks are of the Westinghouse "Reflectolux Sr." type, with bronze globe holders and bronze fittings to withstand the salt air. The lamp and flask are protected by a clear rectilinear glass globe. This offers protection against moisture and is of further advantage in retaining the heat about the light source during cold, windy weather.

Bridge Lighting

Lamps operate on a straight 6.6-amp. series circuit from a constant-current regulator. The luminaire is suspended from a 15,000-volt insulator on a pole crook bracket 20 ft. above the ground.

The Bourne and Sagamore bridges are also illuminated by 10,000-lumen sodium lamps in Westinghouse "Butterfly" luminaires. Spacing of the units is approximately 120 ft. Some variation was necessary due to the

[*Continued on page 98*]

ROADWAY LIGHTING of Bourne bridge over canal shows high visual acuity and absence of glare

Commercial Saturations Boosted by Five-Year Plan

Washington Water Power sells "plus values" of commercial water heating, cooking and baking against lower priced fuels and equipment — Revenue of $22 to $29 per kilowatt-year despite low rates

M. R. LUND, Washington Water Power Company, Spokane, Wash.*

IF WHAT A UTILITY tells its customers regarding electricity for commercial use is true, then there is no good reason why the customer should not accept this story of advantages. If additional business is available for the utility, then a systematic plan of promotion should be carried out.

Such were the conclusions of the Washington Water Power Company five years ago when a review was made of progress in the commercial cooking, baking and water-heating fields. At that time only a small proportion of commercial accounts (today numbering approximately 9,000 in a scattered territory of 40,000 square miles) used electric service. There had been a few counter appliances sold to restaurants and a few bakeovens to commercial bakeries. The commercial eating establishments using electric cooking and baking equipment could figuratively be counted on one hand.

PRIDE OF OWNERSHIP—In this typical commercial installation at Davenport, Wash., the owner displays his installation to frequent visitors. At low 1.7-cent rate, installation yields $22.19 per kilowatt-year

Five-Year Sales Job

Since 1935, after five years of organized sales effort, the percentage of commercial establishments using electricity as a sole means of all baking and cooking needs has increased to one of the highest, if not the highest, in the United States. The percentage of the various classifications of establishments using electricity for all baking and cooking needs are given in Table I.

In addition, many of these establishments now use electricity for water heating as shown in Table II.

It was evident to the commercial sales staff at the outset that in their northwest territory, which held the nation's greatest pine and cedar forests where competitive fuels would have the edge over electricity in any price discussion, electric equipment would have to be sold strictly upon its merit, and in no case upon operating costs. In fact, an attempt to do a little pre-approach arithmetic by adding service costs to the price of equipment, and including wiring, resulted in a very definite conclusion that competition would be severe.

Wood in the northwest sells at from $2.50 to $7 per cord, coal from $8 to $14 per ton, stove oil 8.5 cents per gallon, gas 90 cents per 1,000 cu.ft. and canned gas, quite widely known, from $6.35 to $10 for a 91-lb. container, depending upon the amount used annually per customer. In practically every place where a complete electric kitchen has been installed it has been necessary to provide separate heating units for steam tables and water tanks, because these two items previously received their heat supply from the regular cooking range. This meant a considerable outlay in operating costs to the prospective purchaser.

As an example, one installation where wood was sold at $2.50 per cord operated with a fuel cost of only $16 per month. This equipment was replaced with a modern electric range and a 180-gal. water tank at a monthly electric-service operating cost of

*Commercial and industrial sales manager.

Table I—Saturations of Cooking and Baking Use

	Per Cent
Licensed restaurants	24.8
Commercial bakeries	48.9
Institutions	51.5
Sorority and fraternity houses (five colleges and universities)	74.6

Table II—Water-Heating Saturations

	Per Cent
Licensed restaurants	16.5
Commercial bakeries	16.6
Institutions	10.6
Sorority and fraternity houses (five in number)	38.2

approximately $45. Still, the owner, who was weary of fire hazards, of soot and ashes, of delay and poor cooking results, is now happy.

Another handicap to the acceptance of electric use was the relatively high cost of equipment. Experience indicated that where electrical equipment was installed instead of wood, coal or oil equipment, the more modern electrical equipment cost the customer about twice as much. This was, in the eyes of the sales staff, another drawback. Then, after the equipment was purchased, installation and wiring costs were to be met. These varied from $75 to $300, depending on the type of installation.

Sell the Salesmen

The first selling job to be done in 1936 was with the company's commercial sales organization, convincing them that electric equipment and electric service held certain advantages that would surmount the element of costs. These advantages were readily discovered as direct appeals to pride of ownership, comfort to customers, and dependability and convenience. To acquaint prospects with these advantages trips were planned throughout the territory. Used for these expeditions were large trucks in which the most modern equipment was on display.

One of these was driven directly to a food operator's premises, where he was given an opportunity to view the equipment and listen to the sales story with the least amount of inconvenience. In some instances the demonstration resulted in a new prospect on the spot. But when purchase was delayed, the sales representative stressed the point that electric cooking was giving promise of exceptional popularity. The prospect was asked to watch the number of his acquaintances who were turning to this modern method month by month.

Advertising and promotion materials followed closely with this appeal to "popularity." All of the Washington Water Power customers were consistently circularized with direct mail pieces, containing both sales argument and reminders and announcing that "another of your possible acquaintances has gone all-electric." Splendid testimonials were secured by enthusiastic customers, and these were converted into illustrated folders to show in detail the type of equipment installed.

Salesmen began to assume that business men were divided into two classes—those who were proudly showing their modern equipment to every one who cared to view it and those who perhaps envied their more progressive associates. Naturally, it must be admitted that manufacturers aided immeasurably with custom-built ranges equipped with high-speed units, grease drains and automatic ovens. Heavy-duty equipment had eye appeal and was something to be proud of. Salesmen followed all prospects consistently, with a view to closing the order or preparing detailed sales proposals, showing estimated operating costs and type and size of equipment suggested, together

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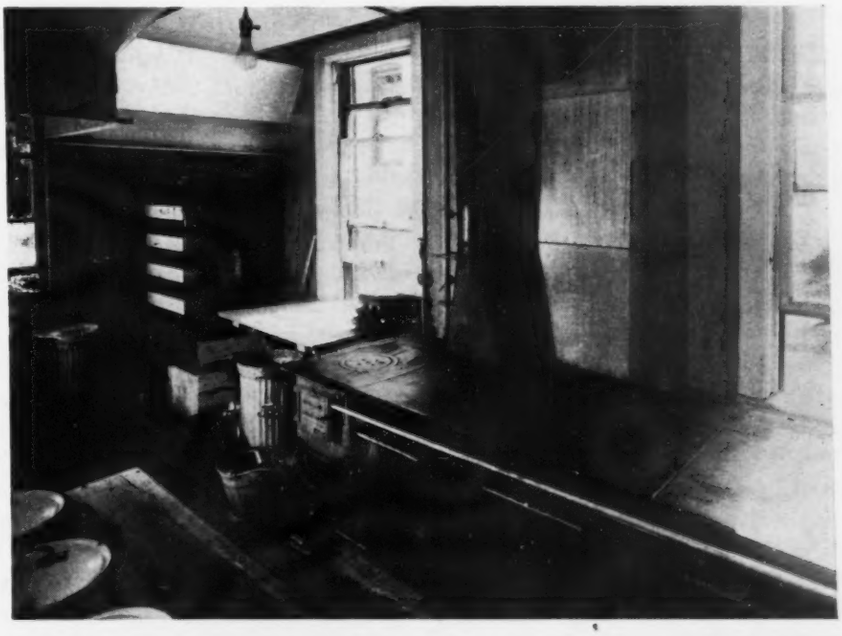

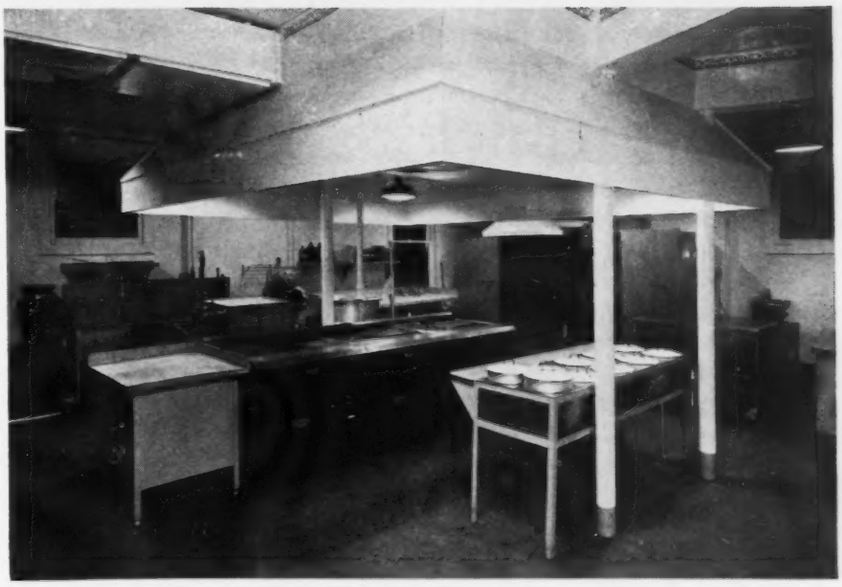

THE PLUS VALUES—Fire hazards, smoke, soot deposits, ash disposal problems, dirt, erratic cooking results, and nerve-wracking working conditions went out the window when this new kitchen in Spokane came in

Editorials

S. B. WILLIAMS, *Editor*

Federal Authority Over Water Power Expanded

THE DECISION of the Supreme Court last week in the New River case is something more than the mere declaration that that stream is navigable and that the Appalachian Power Company must take out a Federal Power Commission license for its Claytor development.

What the legal corollaries might be we are unable to say, but it does not need a legal mind to detect in this decision a disinclination to accept precedent that would have caused judgment in favor of the power company and at the same time a striving and a straining for precedent and fact, however small, as well as a thesis that would be helpful to the government's case.

Two lower courts after hearing evidence declared the New River to be non-navigable. The Supreme Court has in the past accepted a determination of fact held concurrently by two lower courts and confined its opinion to a review of whether the lower courts properly interpreted the facts in law.

While acknowledging this precedent, the court nevertheless, without holding hearings of its own or taking testimony of expert witness, declared that the New River was navigable. Now in the past navigability has been determined as a matter of fact. The present Supreme Court, though striving to prove that the facts do justify a determination of navigability, in reality deserted the precedent of "navigability in fact" for the new theory of capable-of-being-made-navigable by the expenditure of "reasonable" sums of money.

Justice Roberts, in the dissenting opinion, declared that such a thesis would make every creek a navigable stream.

The power company was joined in its case by 41 states seeking to limit the authority of the government wholly to conditions related to navigation. The majority opinion answered the states by holding that the authority of the United States is regulation of commerce, of which navigation is but a part.

Thus, in a decision remarkable for its judicial adroitness, the New Deal kills several birds with one stone. The Water Power Act of 1920 is confirmed. The authority of the FPC over water power is now virtually complete, involving license, regulation and right of recapture in 50 years. State rights are further sterilized.

To some this extension of FPC authority is but a forerunner to further encroachment on state utility regulation.

In any event, it cannot be denied that this decision is one more step in the gradual effort to erase state lines and state sovereignty. Each federal water power license is but the forerunner of a time when certain property will revert to the government and cease to pay state taxes. Sooner or later this clash will become wide open and through legislative or legal action it will be determined.

In the meantime water power is under the guardianship of the federal government.

Progress of Defense Preparations

AMERICAN BUSINESS was startled last week when Defense Commissioner Knudsen told the National Association of Manufacturers that rearmament production had bogged down and was behind schedule. Coming, as it did, on top of previous assurances that rapid progress was being made and that we were ahead of schedule in some instances, it caused many people to wonder if perhaps there wasn't a nigger in the woodpile.

Later reports from others associated with some part of national defense preparations point to satisfactory progress and lead us to believe that Mr. Knudsen's remarks applied to production of military material and not to industry as a whole. Certainly in the case of electrical and power equipment manufacturing we have heard of no breakdown in delivery schedules.

Labor has taken the remarks as meaning that the work week will have to be lengthened if the defense program is to be maintained. In this connection labor has a powerful ally in the present Administration, which has let it be known that it will resist any attempt to cut into the social gains which it has secured.

Others have taken the remarks as laying the groundwork for the establishment of a unified authority over production of rearmament materials and anything associated therewith. This has later been confirmed by the appointment of a four-man board.

At the moment we cannot see how this will affect the electrical industry, except perhaps in securing raw materials should there be any widespread extension of priorities. Outside of turbines, perhaps, it does not appear that there will be a very great expansion of plant to take care of defense needs, so that the machine tool situation is not expected to provide any great problem. Steel might be difficult to get in some instances, also aluminum and possibly zinc.

In general, it might be said that the electrical industry has always been in a position to meet the defense needs, whether for power or equipment, and has not contributed to any bogging down that may have occurred. This, however, does not give any one in the industry the right to rest on his oars. Rather does it supply the incentive to maintain the record of always being prepared.

Research and Freedom

A TABLET was unveiled last week at the fortieth anniversary of the founding of the General Electric Research Laboratory commemorating the vision of Elihu Thomson in seeing so far ahead the need for basic research. Since that time research in the realm of physics, mechanics and chemistry has spread to other electrical manufacturing companies in varying degrees, with the result that the products of the electrical industry are never in a static condition.

While there may seem to be no connection between research and politics, it is possible that the laboratory technician, in his search of nature's secrets, may be the savior of political freedom and of democracy. People give up their right to self-government when the scale of living drops so low that security is more to be desired than freedom. Barring inflation, the outlook as the result of mounting taxes is for a reduced spending income on the part of the individual, with its attendant lowered standard of living, unless industry through lower costs can overcome the reduced buying potential.

To pay the cost of rearmament requires a higher national income. This apparently can come about in one of two ways: Inflation, which means lower purchasing value of the dollar, or by increased production. The philosophy of more and more production for less and less unit price is the one thing that will permit this country to carry the growing burden of public debt without distress.

The research laboratories of industry by finding new materials, new uses, new properties are our hopes for achieving this goal of more and more for less and less.

After this emergency is over we shall need new ideas —ideas that will speed up obsolescence, ideas that will stimulate spending. Only our laboratories are free today to do that kind of research or thinking. Factories jammed with orders give little time to management to plan new products or new lines of endeavor. The problems of today are too often too pressing to take time for tomorrow.

It is for these reasons that we believe that research can in a way be thought of as the guardian of tomorrow's freedom. Give us employment, give us increased production at lower cost, maintain or increase our standard of living and freedom will not be exchanged for security.

New 1941 Ranges

IF MANUFACTURERS of cooking equipment using competitive fuels have been alarmed before over the inroads being made by the electric range, they ought to be really frightened this time. The new electric range designs offered for 1941 are not only better looking but they are better built, have added features and sell for considerably less money.

Unlike manufacturers in other fuel fields, the electric range producers did not cheapen the quality in the lowest-priced numbers. There is no difference in the cooking qualities of a range that sells for less than $100 and one that sells for $150. The only difference lies in "gadgets," that is, the extra equipments, handle trim and such.

If electric cooking was able to overcome competitive handicaps in the past, it should now be able to sail away with the market. The added incentive of low first cost, together with the quality and extra features, augurs well for a big range year in 1941.

Don't Put Everything Into Specifications

SPECIFICATIONS have to be specific about specific things—that is what the word means. But there is no justification for prescribing, for the average case, details which were unusually refined for particularly exacting requirements. It disturbs the manufacturers to have some released information about uniquely good characteristics pop up as a stipulation in the very next purchase order; whether the circumstances warrant such refinement or not is not always established by the specification writer.

Just as one example, there may be taken the matter of turbine vibration. No one denies that some of the first 3,600-r.p.m. machines were humming successes as vibration creators. In certain instances the disturbance was bad enough to necessitate the isolation from the machine foundations of other station parts and facilities which were prone to respond to the 120-cycle disturbing forces propagated from the two-pole generators. One company had to inclose its unit to confine and subdue the noise and vibration.

But now the generator manufacturers are ready with the answers in the form of basic mounting principles. In fact, they are ready to present in quantitative manner the extent to which the new mounting methods reduce the disturbance in the installations for which they were devised. Yet that offers no reason for stipulating that a machine of another proportion and for a different setting should equal or surpass the best results obtained by these initial machines. The problem is new and complex and environments vary. Time should be allowed for digestion of experience before freezing the early results into specifications.

The use of the new forms of stator support to circumvent the inherent tendency to vibrate has been of such short duration that general conclusions cannot be drawn as to the range of results that can be attained. It will be necessary to obtain vibration data on an appreciable number of 3,600-r.p.m. machines in actual service before definite maximum permissible values can be agreed upon.

Meanwhile there is no proof that vibration is likely to have deleterious results within the generator itself. As for harm and annoyance elsewhere, it may even prove cheaper in some instances to resort to correctives external to the generator. In any event, there should be no haste to "write it into the specifications" while the designers of stations and equipments decide how far they need to go in circumventing a two-pole phenomenon of nature.

Building for the Future to Meet Today's Load

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

CAPITAL AND LABOR, says Bill Knudsen, must roll up their sleeves and get to work, because national defense is lagging badly. That makes sense. Everybody knows it is true.

Authorized Administration spokesmen have told large groups of business men, in the last few weeks, that Britain may not be able to last more than 90 days, that speed in helping her is imperative. Few have adequate information to pass intelligently on that.

Let's assume it to be true, and look at the problem presented.

Either the rush aid we are able to deliver to Britain in the next few months will save her or it will not.

If it does, obviously there will be necessity to continue the effort during the months to follow. If it does not, the emergency we have been hearing so much about will be on our doorsteps in a few months.

More Power Won't Help

What will be done to aid Britain in that 90 days? Certainly nothing which has to do with production not already started. So we can dismiss the alleged possible shortages of electric power in that connection.

What about the emergency after Britain falls, if worst comes to worst? The same answers would seem to apply unless the emergency stretched into years.

So why does the National Defense Commission waste time worrying over details of new hydro projects? That does not seem to make sense.

Contracts being let now for steam plants to produce electricity contemplate actual production of power some time in 1942. It is common knowledge that it takes much longer to get a hydro plant into production, starting from scratch, than a steam plant.

Yet we have the President solemnly telling Senator Richard B. Russell of Georgia that if the Defense Commission approves the Clarks Hill project on the Savannah River he will give that project the green light. Which apparently means that the Clarks Hill project is not only to be considered a national defense objective, but that it will be financed, in part at least, by the blanket funds Congress voted to the President, to be used in his discretion for defense purposes!

It may not be as flagrant as the St. Lawrence development, discussed two weeks ago in this space, but it seems pretty thick! There is no purpose here to criticize the merits of the Clarks Hill project. If it can be constructed as cheaply as the estimates indicate—generally a violent assumption on government work—it will produce current for about two and seven-tenth mills.

Actually, of course, the underlying purpose has nothing to do with national defense. Certainly nothing to do with the present war, and having no possibility of any repercussion on the possible calamity in Britain.

The purpose is twofold. Primarily it is part of the battle President Roosevelt has been waging since he assumed office to spread public ownership of the electric industry. The second purpose is his long-felt desire to industrialize the South.

Tongue in Cheek

This last has been stated many times, but it has never really been taken seriously, even by New Dealers. It was stated in connection with TVA. It was stated again in connection with Santee-Cooper. This last, by the way, is now seeking $35,000,000 of federal money to buy out a subsidiary of the Associated Gas & Electric, and add South Carolina to Tennessee in the column of states which have virtually eliminated private initiative in the electric business.

For some reason the Administration was slow in grasping this "opportunity" at Clarks Hill. Senator Russell was quite peeved about it. Last summer he held up an appropriation for further TVA development, making light of the alleged national defense motive for speed, and asserting frankly that Tennessee would get no more federal money for dams until Georgia got her share.

"Tis sweet to hear the honest watchdog's bark
Grow fainter as we draw near home."

Obviously, no hydro and, for that matter, no steam plant, for the production of electricity which is now in the blueprint stage is going to play any part in any "emergency" now on the horizon. Which brings us down to this—suppose, all the clamor about a "shortage" of electric power has some foundation? The best judgment in the industry is to the contrary, but suppose a shortage should develop?

A Simple Remedy

Isn't it obvious that there is only one thing to be done, and that is to curtail such expenditures of power as may not be essential to the war effort? In no single study of the electric situation which the writer has been able to find—speaking now exclusively, of course, of governmental activities—is there any discussion of this possibility.

During the last world war this country cheerfully underwent heatless days and meatless days. There was a critical shortage of coal. People who worked unusual hours and on Sundays frequently had to do without elevator service. There was a shortage of gasoline. People were not supposed to drive for pleasure on Sundays. There was very general compliance with all the restrictions, and very little complaint.

Now how is the shortage about which the Administration experts talk so much computed? Isn't it a contrast between an estimated possible maximum need—a sort of super peak—and the estimated production of that particular hour?

Not really a terrible problem, is it, if our country should be in danger?

NEWS OF THE WEEK

North American System Expands Plant Capacity

Original 1940-41 program doubled within last six months to meet national preparedness plans — President Shea informs national defense advisory committee that power needs will be met

North American Co. has advised the electric power subcommittee of the National Defense Advisory Committee that the further expansion of the company's system power preparedness plans within the last six months has doubled the amount of new plant capacity which was contemplated originally in its 1940-41 program.

The company's letter to Gano Dunn and Leland Olds, subcommittee members, called attention to the announcement of a further plant addition of 80,000 kw. in the St. Louis area. This followed previously authorized increases totaling 190,000 kw. in the construction programs for the Cleveland, Washington and Milwaukee areas.

Tour Properties

President E. L. Shea sent the letter to the national defense subcommittee upon his return last week, with other company officials, from a tour of some of the operating properties in the system.

"With this latest expansion," Mr. Shea wrote, "and the substantial construction increases reported to you in our letters of June 25 and July 15, the North American System's program provides additional generating capacity of 540,000 kw. at a total cost for new power plants and other utility facilities of approximately $104,000,000. This will increase by one-fourth the total capacity of more than 2,100,000 kw. which the North American system had available at the beginning of 1940."

Mr. Shea pointed out that the enlarged program is designed to fulfill the assurance given the subcommittee last summer that no power bottlenecks would be permitted to develop in the various operating areas of the system to hinder national defense preparedness.

"Since scheduling this additional capacity in the St. Louis area," the letter added, "we have read with interest the initial report made by the Federal Power Commission in its survey of the country's power needs for national defense. In this connection we are glad to reiterate the determination of the North American System to see to it that adequate supplies of power will be available to meet not only abnormal demands but even extreme emergencies in all the highly industrialized areas served by our companies.

"We are well aware of the commission's concern for the early completion of new power plant projects throughout the country and we are glad to give you the details of the North American's time schedule. Since our last letter to you three projects aggregating 90,000 kw. have been completed, four of 180,000 kw. are expected to be in operation in 1941, three of 190,000 kw. are to be ready in 1942 and one of 80,000 kw. is scheduled for completion in 1943.

Mr. Shea listed these plants as follows:

ST. LOUIS AREA—Union Electric Co. of Mo., Ashley Street plant, 25,000 kw. completed last November. Union Electric Co. of Ill., Venice plant, 80,000 kw., two 40,000-kw. units in fall of 1941 and one 80,000-kw. unit in fall of 1942.

CLEVELAND AREA—Cleveland Electric Illuminating Co., Lake Shore plant, 60,000 kw. in May, 1941, and 60,000 kw. in May, 1942.

MILWAUKEE AREA—Wisconsin Electric Power Co., Commerce Street plant; 35,000 kw., summer of 1941; Port Washington plant, 80,000 kw. early in 1943.

WASHINGTON AREA—Potomac Electric Power Co.; Buzzard Point plant, 50,000 kw. completed last October and 50,000 kw. to be completed February, 1942.

KANSAS-MISSOURI AREA—Kansas Power & Light Co., Abilene plant, 15,000 kw. completed last July. Missouri Power & Light Co., Brookfield plant, 5,000 kw. to be completed in February, 1941.

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Duke Power to Add New 40,000-Kw. Unit

Duke Power Co. will build an addition of 40,000 kw. at its Buck steam power station near Spence, N.C., to be ready for operation in August, 1942.

Charles I. Burkholder, vice-president and chief engineer, said that the 80,000-kw. addition now under construction at the plant would be ready for operation next July. The two additions will bring the total of the station to 190,000 kw.

Court Holds Invalid TVA Power Contract

Special legislation will be necessary before any municipality in Kentucky can sign a TVA power contract, according to interpretation of the decision of the Court of Appeals last week in holding that the city of Middlesboro contract with TVA for electric power was invalid.

The court held that the contract was a surrender of city government to TVA and in effect tied the hands of the city, the courts and the General Assembly. An earlier opinion had held the contract valid except for certain specified clauses.

Middlesboro signed its contract to purchase TVA power July 29, 1937.

CHRISTMAS GIFTS—At top, New York employees of the Electric Bond & Share System companies made many a poor child happy Christmas by this array of toys gathered under the direction of Miss Margaret Van Mater. Below—Some of the more than 500 girls of Consolidated Edison Co. of New York with the stockings they filled and dolls and toys collected for gifts to the orphans at the New York Foundling Hospital. L. to r.—Christina Hammer, Florence McClellan, Evelyn Kreig and Rita Kelly

Citizens had voted approximately two to one for a $175,000 bond issue to finance construction of a municipal system to distribute TVA power.

Shortly before the agreement to sell the bonds was signed on September 15, 1937, Kentucky Utilities Co. filed suit to enjoin the city from proceeding with its contract.

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Better Wiring Reported in Pacific Coast Area

Evidence of adequate wiring progress has been found in 1940 figures for new home construction in San Francisco, upon examination by the Pacific Coast Electrical Bureau. The bureau's Red Seal Wiring Certification is awarded to homes meeting certain requirements established by the Bureau. In San Francisco homes built this year, it was found that all meet the requirement of a kitchen ceiling light controlled by a wall switch, 90 per cent meet the requirement of at least three convenience outlets in the kitchen and 50 per cent meet the requirement of a light over the kitchen sink.

The Red Seal certificate is awarded only when homes are adequately wired throughout, but the above figures indicate a general trend toward better wiring.

Central Power Would Sell Nebraska Units

Purchase of properties of Central Power Co. in some 40 Nebraska towns for $6,800,000 and to complete the deal shortly after the first of the year is planned by the Consumers Public Power District of Columbus, Neb. Central Power, a subsidiary of Middle West Corp., has generating plants in Grand Island, Nebraska City and Kearney, Neb.

Company officials explained that the proposal is part of the integration moves by Middle West. Northwestern Public Service Co., another Middle West subsidiary, proposes to acquire the gas utility properties and assets at Grand Island, Hastings and Kearney, Neb. The price is $760,000. SEC has been asked to sanction the transactions.

The Federal Power Commission has authorized the Interstate Power Co. to sell, and has approved the proposed sale of, the company's electric facilities located in Nebraska to the Consumers Public Power District. The district proposes to pay $2,600,000 for the properties and will finance the purchase by issuance of $3,100,000 of serial electric revenue bonds.

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Associated Gas Trustees Ask Court to Name Rogge

Trustees of Associated Gas & Electric Corp. have applied to Federal Judge Leibell for a court order appointing O. John Rogge, formerly assistant attorney-general in charge of the Justice Department's criminal division, special counsel. The court approved the appointment this week.

Mr. Rogge will concern himself primarily with litigation in connection with the recapitalization plan of 1933, under which approximately $200,000,000 of the $270,000,000 of Associated Gas & Electric Co. fixed interest obligations were exchanged for securities of the concern's sole directly owned subsidiary, Associated Gas & Electric Corp. It is expected that the trustees of the company will challenge the legality of the plan.

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Buffalo Appliance Sales

A total of 1,336 electric ranges and 242 electric water heaters were sold during the recent campaign of Buffalo Niagara Electric Corp. and scores of participating dealers. Significant was the fact that dealers' sales ran ahead of sales by the utility. Dealers sold 953 ranges.

Pacific Northwest PUDs Would Buy Utility Units

Plan to purchase properties of Pacific Power & Light and Puget Sound Power & Light facilities — Government, municipal and private plants figure in new state-wide proposal

Public ownership of private utilities operating in the Pacific Northwest has advanced another step with a proposal for a system-wide acquisition of properties of Puget Sound Power & Light and Pacific Power & Light companies. It is believed that once the public utility districts and the Bonneville-Grand Coulee administration reach an understanding as to the functions of each and how acquisition of the utility properties is to be financed the movement will progress rapidly.

PUDs Hold Meeting

Last week PUD commissioners from Klickitat, Benton, Skamania and Yakima counties in Washington and Wasco and Hood River counties in Oregon read two proposals for acquisition of properties of Pacific Power & Light Co. Private financing was proposed by a bond house, while L. Marlett, executive assistant to Paul J. Raver, expressed willingness of Bonneville to negotiate the purchase and the assurance of RFC loans. He emphasized that individual districts could later refinance privately by selling bonds at public auction. Mr. Marlett stated that Bonneville could not enter negotiations if purchase is undertaken privately.

The meeting was called by the Columbia Valley Public Power Corp., a non-profit organization, of which the PUDs in the territory are members. There was wide difference of opinion over the method of financing the purchase of the private utilities in the territory. Many commissioners expressed dissatisfaction with the way the Bonneville Administration had acted in the preliminary negotiations on the Pacific Power & Light deal to date. J. R. Farden, Hood River County PUD commissioner, objected to the government's dictation in the operation of the districts.

Dr. Raver has made known that while Eastern financiers continue to buy Puget Sound Power & Light rising stock in huge amounts, his office is preparing a plan for the purchase of the company production and distribution system. The stock of the utility dropped as low as around $10 a share two years ago and lately has risen to $58 bid and $60 asked. Last January it was $30 a share and in January, 1939, it was $15. There are unpaid dividends of $48.50 a share on the 263,995 shares of $6 preferred stock outstanding.

Seattle Purchase Plan

Plans are under way for the purchase by Seattle's City Light of the Puget Sound Power & Light properties. Plans call for a state-wide power pool. This would be financed by federal agencies in co-operation with PUDs and municipalities. Power of Grand Coulee and Bonneville would be pooled with Seattle's City Light and Tacoma's municipal system and other private and public plants.

It is proposed to organize an "overall" corporation through which Bonneville, with funds loaned by RFC, would take over all production and distribution facilities. This new agency would probably be the Columbia River Power Authority, a proposal now before the Congress.

Grays Harbor PUD commissioners have ordered prepared a plan and system resolution calling for purchase of Puget Sound Power & Light properties in Eastern Grays Harbor County or construction of PUD lines to compete with the company's lines. Officials of the PUD declared that the price to be offered to the utility is expected to be between $300,000 and $400,000.

WHAT MATTERS if insulatorless guys fraternize with pole steps, transformers have grilled manhole covers for bottoms, arresters look like ice cream cones, buck-arms hug one another and all arms carry rainsheds on the ends? Why should R. W. Wilbraham's committee worry about such technicalities so long as the brethren patronize the A.I.E.E. winter convention dinner dance?

MKB to Start Water Heater Sales Drive

The Modern Kitchen Bureau has completed its plans for the 1941 water heater program. The new campaign "Electric Water Heater Jubilee" points its efforts for dealers toward the greatest sales year in history.

Chairman Walter H. Sammis says that the promotion offers utilities the best material that has even been provided to increase the sale of electric water heaters and thus secure increased load from this important appliance.

With nearly a million homes now using electric water heating, Manager H. L. Martin says, consumer acceptance of the electric water heating idea is definitely here. Pioneering days are over and the time has come when sales will be easy to make, he declares.

New posters, ads and radio programs have been provided to spur sales. Thirteen major manufacturers created and are supporting this MKB program.

SEC Rules Cities Service Must Register Under Act

SEC ruled this week that Cities Service Co. must register under the holding company act in denying the application of the company from exemption of the provisions of the act.

The commission ruled that Cities Service Co. is "not incidentally a holding company" and contended that the company derives a material part of its income from its utility subsidiaries.

LCRA to Get RFC Funds

The Lower Colorado River Authority has been notified that the RFC has approved its application for a $1,647,000 loan for the purchase of electric power distributing systems in parts of seven counties of central and south Texas. The counties include Gonzales, DeWitt, Fayette, Lavoca, Colorado, Gillespie and Kendall.

FPC Terminates Power Quiz of Five Utilities—

Investigation of alleged political activities and expenditures concluded in Los Angeles — Data accumulated at hearings likely to form basis of report to Congress for legislation

Terminated is the Federal Power Commission's investigation into alleged political activities and expenditures of five Pacific Northwest electric utilities. Trial Examiner Samuel H. Crosby concluded the investigation last week in Los Angeles, with the completion of testimony by S. P. MacFadden, executive vice-president of Puget Sound Power & Light Co.

Data accumulated throughout ten weeks of hearings will be digested by the FPC, after which there is the prospect of a report to Congress, which may form the basis of far-reaching legislation with respect to utility regulation.

Defense Against Attacks

Mr. MacFadden's testimony largely paralleled that of other Northwest executives who testified to the small percentage of revenue devoted to defense against attacks by public ownership advocates. He pointed out that over the last five years the Puget Sound system spent only $63,305 on public ownership matters, representing only 0.078 per cent of the company's gross revenue and only 0.689 per cent of its net income. Of the amount, $31,425 was in payments to the Washington State Tax-payers' Assn.

In earlier testimony Mr. MacFadden had brought out that since 1930 the company had voluntarily reduced its charges by over $3,000,000 through rate reductions.

Shifting of the hearing to Los Angeles had taken place to permit hearing the testimony of J. Frank McLaughlin, president of Puget Sound, who was ordered to southern California by his physician. He appeared there on the stand, but much of his testimony was in written form. He emphasized his consistent policy of keeping the company free from politics, and stated no contribution, direct or indirect, had been made to elect or defeat any candidate for public office.

"One of my consistent policies," he said, "has been to make clear our company's position on any issue affecting the welfare of the company, its investors, its employees, or its customers. My idea about operating a public utility has always been to lay the cards on the table and frankly discuss our problems with the public."

Throughout the weeks of hearings, little not previously known or recorded was brought to light. Some felt those advocating public power had achieved the end they desired through publicity incident to the hearings prior to election time. It was felt this influenced defeat of a Washington State initiative measure which would have compelled public utility districts to submit revenue bond issues to public vote.

Into the array of testimony was introduced the voice of the Bonneville Power Administration, when the following telegram was introduced into evidence. Addressed to H. H. Beetle, Mayor of Port Angeles, Wash., and signed by C. E. Carey, assistant chief of the system planning and marketing division of Bonneville, it read in part:

"Pursuant to your request, our staff has studied feasibility of extending Bonneville-Grand Coulee power service to your city. Our studies indicate that we would not be justified in building new transmission lines. The only practical way for us to deliver Columbia River power into the Olympic peninsula area is by acquisition of Puget Sound Power & Light Co. transmission lines. Bonneville and PUD are now negotiating with the company for system-wide acquisition based upon the ability of each county to establish own agency for acquisition and operation of the company's distribution properties. . . ."

Related to this was another piece of evidence, an advertisement from a Port Angeles newspaper which said: "The city commission says: 'We can have Bonneville power without a PUD.' The facts are these—the Bonneville authority has told the city commission that it is very desirable to have a PUD. The federal government wants this method of getting you cheap power."

1941 APPLIANCE LINE—W. J. Russell (left), manager of engineering, demonstrating the workings of the new "Laundromat" to Stanley Fisher, market development manager, and to Frank Kohnstamm, sales manager of the merchandise division, at the preview in New York last week of the new line of Westinghouse appliances

Westinghouse Shows New Appliance Line

An informative labeling program designed "to provide consumers with the information they want to know about electrical appliances" was announced last week by Westinghouse Electric & Manufacturing Co. at its preview of the 1941 lines of appliances in New York.

Introduced publicly for the first time were two new developments, the "Laundromat," the new automatic cycle washer, and a reverse cycle air conditioner which provides cool air in summer or warm air in winter.

Frank R. Kohnstamm, sales manager of the merchandising division, declared that the labeling program will provide customers with the "beneath-the-sur-

face" details and a more intelligent appraisal of the products.

The "Laundromat" is being manufactured at Mansfield, Ohio. For quantity production, parts will be fabricated and enameled in new buildings, part of the company's $1,500,000 expansion program. Between 200 and 300 new employees will be added for manufacture of the new product.

To honor a trio of notable early American women, Martha Washington, Dolly Madison and Betsy Ross, the 1941 refrigerator line has been styled in a Colonial mode. Color has been introduced in plastic panels of soft pastel shades with colored dishware to harmonize.

A single set switch is used on the new electric range to make cooking automatic. Simplification has been emphasized by reducing the number of models to seven. Another feature is placing of all switches on the back panel.

The plug-in air conditioner attracted considerable attention at the preview. It is slightly larger than a table model radio and can be installed in any ordinary window. It has a capacity of 6,000 cooling units an hour and a heating capacity of 7,500 heating units an hour and up, depending on the outside temperature.

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Illinois Utilities Will Build New Rural Lines

Certificates authorizing construction and operation of 37.39 miles of rural electric lines in Lee, Whiteside, Ogle, Carroll, Bureau, Jo Daviess, Stephenson, Crawford, Sangamon, Lake, Ford, LaSalle, Marshall, Kankakee and Livingston counties have been granted by the Illinois Commerce Commission to three utilities companies.

These companies and the miles of lineage each will build are: Illinois Northern Utilities Co., 26 miles; Central Illinois Public Service Co., 1.51 miles, and Public Service of Northern Illinois, 9.88 miles.

The lineage in Sangamon County is to be built by the Central Illinois Public Service Co. in Auburn township and will be one mile in length.

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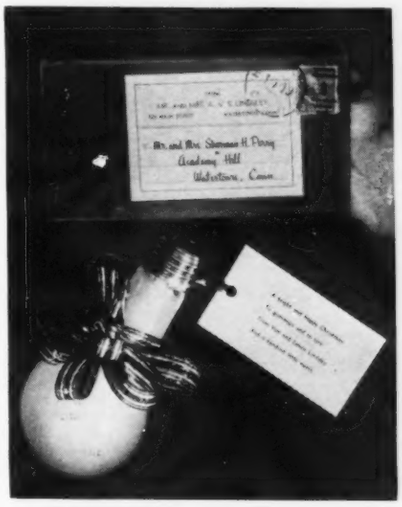
Connecticut Rural Lines

The Connecticut Public Utilities Commission has reported to Gov. Raymond A. Baldwin that all rural communities in the state will be receiving electric power within the next four years, if the present rate of expansion is maintained by the private power companies.

NEWS BRIEFS

TEAMWORK in national defense between Boston Edison engineers and Bethlehem Steel speeded procurement, transportation and delivery by harbor towing and setting of extra long poles from New Hampshire in six days to protect an East Boston dock having 37.5 kw. of floodlighting.

A NOVEL Christmas greeting was received by friends of A. V. S. Lindsley, vice-president of Connecticut Light &



Power Co., in the form of a 100-watt inside-frosted Mazda. It was a hundred little watts for grown-ups and tots.

"WE CAN GIVE YOU prompt counsel and co-operation in any project of yours which might require power," says Bonneville Administrator Paul J. Raver, as the administration opened branch offices in Yakima, Spokane and Eugene.

ONE FOR REA enthusiasts is the new policy of Iowa Electric Light & Power Co. From now on appliances may be sold from the company stores to customers on REA lines. Installment paper on such sales will be handled through the REA co-operative if the REA has qualified as an EFHA agency. The company says that sales employees will not be expected or allowed to solicit business on REA lines. Sales must be entirely store sales.

FEDERAL POWER COMMISSION has published an 800-page "Directory of Utilities in the United States," listing data furnished by private and publicly owned electric utilities. It is $2 a copy.

THE AMOUNT Public Service Co. of Indiana formerly contributed to employee insurance will be doubled under the new plan of group insurance. Employees have subscribed for $4,000,000 of low-cost term insurance and individual life coverage in amounts ranging from $1,250 to a maximum of $10,000. After three years, President R. A. Gallagher said, the employee's group insurance will be reduced and he will receive a permanent form of insurance which is paid up at age 65.

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Power Interruption Occurs in Washington

An interruption of from fifteen minutes to two hours occurred in the Washington, D. C., area on Friday morning, December 20, just as Benning plant of Potomac Electric Power Co. was preparing to pick up the day's load at its start.

The Washington system was operating in parallel with the Safe Harbor hydro-electric plant when at 6:47 a.m. the first of the steam units was being synchronized for load duty. At that instant a breakdown in a hydro unit on the Baltimore system is reported to have caused a severe disturbance, noted by the Washington operator in erratic behavior of the instruments on his panel. Fearing that his own machine was in distress, he cleared the machine from the bus, and thus, with the interconnector tripping because of the trouble on the Baltimore Safe Harbor system, the Washington system was entirely without supply for about five minutes. Voltage was recovered as local generators were made available, but the railway load was not picked up in full until somewhat after 8 a.m. subsequent to restoration of essential services.

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Sponsors Light Displays

Public Service Electric & Gas Co. of New Jersey made extensive use of billboards, direct mail, newspaper and women's club magazines in the promotion of Christmas lighting. Electric decorations have gained in popularity throughout the company's territory as a result of its promotional efforts. The company led the way by decorating its own buildings and show windows.

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Hygrade Sylvania Bonus

Christmas checks were distributed last week to 4,600 employees of the Hygrade Sylvania Corp. The gift went to each employee on the payrolls and amounted to one week's pay at each individual's rate, on a 40-hour weekly basis, with a maximum of $25.

Centralized Buying Plan for Army Units

Centralized purchasing of equipment and fixtures for houses in the defense housing program—for industrial workers, civilian employees of the military and enlisted men's families—is being pushed in Washington. The Treasury Department's Procurement Division is handing the work for the Federal Works Agency.

The centralized purchasing will apply specifically to such items as refrigerators (nearly all electrical), ranges (perhaps some electrical) and water heaters (a few to be electrical). Efforts also are being made to handle lighting fixtures the same way. Originally, it was felt that packaged supplies of all electrical equipment (wiring cut to size, switches, sockets, etc.) could also be put up in large quantities for mass buying, but this plan has been shelved at least temporarily; the first project under contract—700 units in two-story, four- and eight-unit multiple buildings at Fort Knox, Ky.—provides that the contractor obtain and install electrical wiring at the site.

The centralized purchase program is just swinging into action. Specifications, very broadly worded, have been drafted on bathroom and kitchen units and every manufacturer in the field is asked to submit bids on 1,000-unit lots. It is not proposed to seek open-quantity contracts. Instead, items will be bought outright in lots of 1,000 or 10,000. If the maker has storage facilities, he will be asked to store the product. If not, he can deliver to government warehouses.

Current for these housing developments will be obtained from existing distribution systems wherever possible and it is probable that individual metering and billing will be provided except at Army reservations.

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Bonbright's New Book Airs Power Program

The results of the New Deal power program, so far as they can be judged to date, seem highly encouraging, Prof. James C. Bonbright says in a study of "Public Utilities and the National Power Policies," issued by the Columbia University Press.

Professor Bonbright, who is chairman of the Power Authority of the State of New York, says that both in its engineering and in its financial aspects the power industry is far sounder than it was in 1929. "Most of the completed public water-power projects are proving great national assets in conjunction with the private plants," he declares.

The downward trend in rates, accompanied by increased use of electricity, is discussed by Professor Bonbright in the light that this result has been accomplished by the example or threat of public ownership. He says that this has been accomplished without impairment of corporate earning power. He discusses the utility act in relation to holding company procedure as well as the uniform system of accounting.

The discussions of Professor Bonbright give some idea as to the thinking in government power circles toward private utilities in relation to public projects and laws affecting the privately owned companies.

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Cuba Studies Utilities

A commission of eleven majority and six minority Senators has been appointed by the Cuban Senate to investigate the concessions of all public service companies with a view to corrective legislation, if this is found needed, according to reports from Havana.

MEETINGS

American Association for the Advancement of Science—Bellevue-Stratford Hotel, Philadelphia, Pa., December 27-January 2.

Housewares Manufacturers Association—National Housefurnishing Show, Palmer House, Chicago, Ill., January 5-11.

Louisiana Engineering Society—Annual meeting, St. Charles Hotel, New Orleans, La., January 10-11. Mr. A. M. Hill, secretary-treasurer, 422 St. Charles Hotel, New Orleans.

Missouri Valley Electric Association—Power sales conference, President Hotel, Kansas City, Mo., January 16-17.

Canadian Electrical Association—Annual winter conference of association committees, Montreal, Que., January 20-21. B. C. Fairchild, secretary, 804 Tramways Bldg., 159 Craig St., West, Montreal.

American Society of Heating and Ventilating Engineers—Annual meeting, Muehlebach Hotel, Kansas City, Mo., January 27-29. A. V. Hutchinson, secretary, 51 Madison Avenue, New York, N. Y.

American Institute of Electrical Engineers—Winter convention, Philadelphia, Pa., January 27-31. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

Edison Electric Institute—Electrical equipment committee, Statler Hotel, Detroit, Mich., February 10-12; transmission and distribution committee, Statler Hotel, Detroit, February 17-19. Major H. S. Bennion, managing director, 420 Lexington Avenue, New York, N. Y.

American Institute of Mining and Metallurgical Engineers—Annual meeting, Institute headquarters, New York, February 17-20. A. H. Parsons, secretary, 29 West 39th Street, New York, N. Y.

National Electrical Manufacturers Association—Winter meeting, Palmer House, Chicago, Ill., February 17-21. W. J. Donald, managing director, 155 East 44th Street, New York, N. Y.

Oklahoma Utilities Association—Annual convention, Tulsa, Okla., March 17-18. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

American Society of Mechanical Engineers—Spring meeting, Atlanta, Ga., April 1-3. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Midwest Power Conference—Fourth annual meeting, Palmer House, Chicago, Ill., April 9-10. Charles N. Nash, conference secretary, Illinois Institute of Technology, 3300 Federal St., Chicago, Ill.

Electrochemical Society—Spring meeting, Cleveland, Ohio, April 16-19. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Start Draft on New St. Lawrence Treaty

Negotiations for a new St. Lawrence Waterway treaty, embracing both power and navigation rights, are actively in progress between the United States and Canada. Present plans have scheduled the new treaty to be ready for submission to the U. S. Senate early next year, probably in January.

Disclosure that a new treaty is being drafted by the joint U. S.-Canadian committee apparently indicates that the New Deal Administration will not, at least at once, seek to build the power dam in the international rapids without a formal treaty.

That the proposed new treaty also is to dispose of navigation rights in addition to power, however, conflicts with the President's recent statements that the project is being revived now solely as a means of providing more electrical energy for defense industries of the two nations. If the navigation clauses remain in the treaty as sent to the Senate a full-dress battle over ratification is assured.

Release of correspondence between the State Department and the Canadian Minister relative to the immediate additional diversion of Niagara water by Ontario and to the joint international committee to carry on preliminary engineering work for the rapids dam contained little which was not already known. Minister Christie's letter to Secretary Hull, dated October 31, stated that the Canadian Government was directing Ontario to begin the additional diversion at once, although the agreed upon replacement of water from the Hudson Bay watershed cannot be made fully effective for some time.

The correspondence also brought out the fact that the $1,000,000 President Roosevelt advanced from "blank check" funds to the joint committee and the Army Engineers was allotted on the understanding that these costs ultimately are to be prorated by agreement between the two governments.

•

FPC Fixes Project Cost

Federal Power Commission has announced the determination, as of April 30, 1938, of the actual legitimate original cost of the Winfield hydro-electric project of Kanawha Valley Power Co., located on the Kanawha River, near Winfield in Putnam County, W. Va., at United States Government Dam No. 1.

The commission in its determination fixed the cost of the plant at $1,903,307, as compared with the licensee's claimed cost of $1,920,568, the disallowed items amounting to $17,261.

Power Production Hits All-time High

Power production scored a new all-time high in the week ended December 21, totaling 2,910,914,000 kw.-hr., a gain of 10.2 per cent over the corresponding week of last year, according to the Edison Electric Institute. During the corresponding week of a year ago, when power output reached its customary winter peak, the total was 2,641,458,000 kw.-hr.

Production of electricity in the most recent week was about 1.8 per cent above the preceding week and sharp gains were reported for the different geographic areas. According to reports from the industry, the gain over the preceding week was not as sharp as in previous years. This was attributed to the fact that during the past week the weather was not as cold and the skies were clearer for more hours during the day.

National defense production is reflected in the power output figures and it is expected that as the government exerts pressure for a speed-up in defense orders, the energy output will rise sharply over the next few weeks.

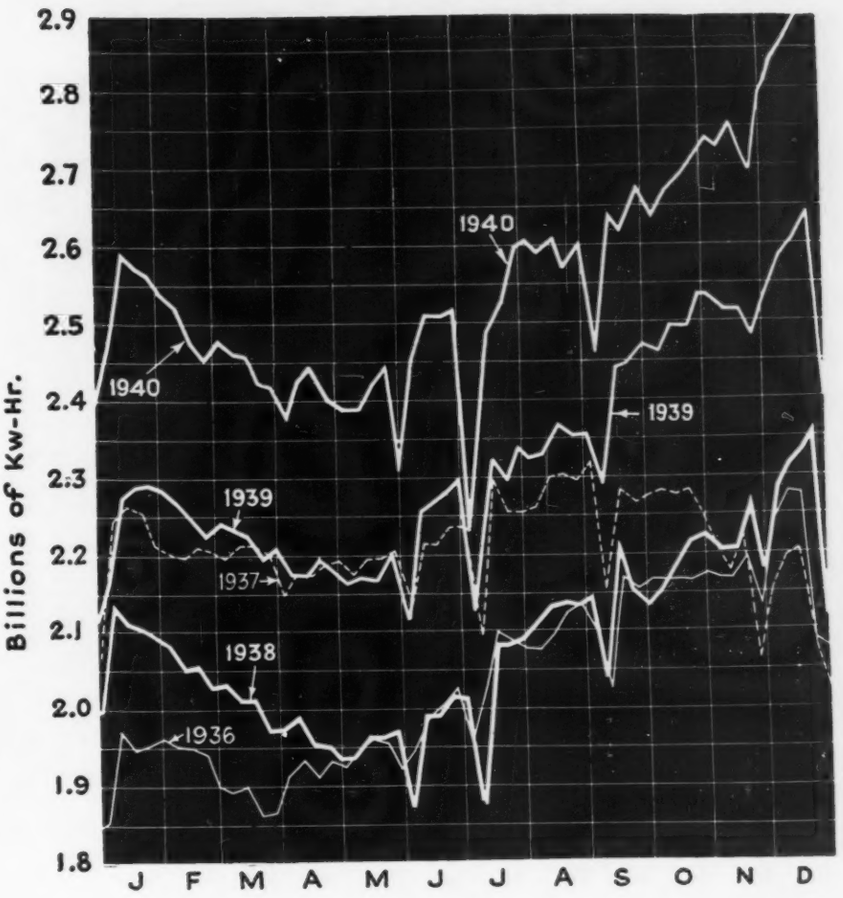
Except for the Pacific Coast area, all of the major geographic regions showed increased percentage changes over 1939 from the previous week.

Weekly Output, Millions Kw.Hr.

1940		1939		1937	
Dec. 21	2,911	Dec. 23	2,641	Dec. 25	2,085
Dec. 14	2,862	Dec. 16	2,605	Dec. 18	2,202
Dec. 7	2,838	Dec. 9	2,586	Dec. 11	2,196
Nov. 30	2,796	Dec. 2	2,539	Dec. 4	2,153
Nov. 23	2,695	Nov. 25	2,482	Nov. 27	2,065
Nov. 16	2,752	Nov. 18	2,514	Nov. 20	2,224
Nov. 9	2,720	Nov. 11	2,514	Nov. 13	2,177
Nov. 2	2,734	Nov. 4	2,537	Nov. 6	2,202
Oct. 26	2,711	Oct. 28	2,539	Oct. 30	2,255

Per cent Change from Previous Year

	Week Ending		
	Dec. 21	Dec. 14	Dec. 7
New England	+ 6.7	+ 5.2	+ 6.7
Middle Atlantic	+ 8.5	+ 7.8	+ 9.3
Central Industrial	+12.5	+11.7	+11.9
West Central	+ 8.7	+ 8.3	+ 6.3
Southern States	+10.0	+10.7	+10.5
Rocky Mountain	+12.3	+ 7.9	+ 3.6
Pacific	+ 9.0	+ 9.3	+ 7.0
United States	+ 9.0	+ 9.9	+ 9.8



Urban Steam Plant's Value Is Explained

Although the State Street steam plant of the United Electric Light Co. at Springfield, Mass., generated but 30,000,000 kw.-hr. last year on a coal rate of about 2 lb. per kilowatt-hour, it performed economic service for the system, according to recent testimony by J. P. McKearin, chief engineer of the Western Massachusetts Companies, before the state Department of Public Utilities in a rate inquiry before the board. The plant is located on the Connecticut River in the heart of the city, and while it has been in service many years, it provides a valuable source of energy for an area to a large extent supplied by transmitted power. The station is also a major distributing point.

Mr. McKearin testified that a new plant capable of delivering energy on a 1-lb. coal rate would cost about $3,000,000. This fuel saving would mean $90,000, or 3 mills per kilowatt-hour on the above output, but with 13 per cent fixed charges the company would be paying $390,000 per year to save the foregoing sum. The State Street station is regularly available and operated effectively in connection with the supply of energy from the incoming transmission lines of the affiliated Western Massachusetts system. From 1928 to the close of 1939 the United company has saved $2,500,000 in power costs by purchasing a substantial portion of its requirements from the Turners Falls company, as compared with utilizing a new steam plant in conjunction with State Street. The average cost of purchased energy to the United in 1939 was 9.6 mills per kilowatt-hour.

•

Primary Load Rises 7%

Hydro-Electric Power Commission of Ontario reports primary load for all systems in November at 1,860,450 hp., against 1,738,147 hp. in November last year, an increase of 7 per cent. Primary and secondary loads for all systems totaled 2,080,691 hp., against 2,046,894 hp. in November, 1939, an increase of 1.7 per cent.

•

New Transmission Line

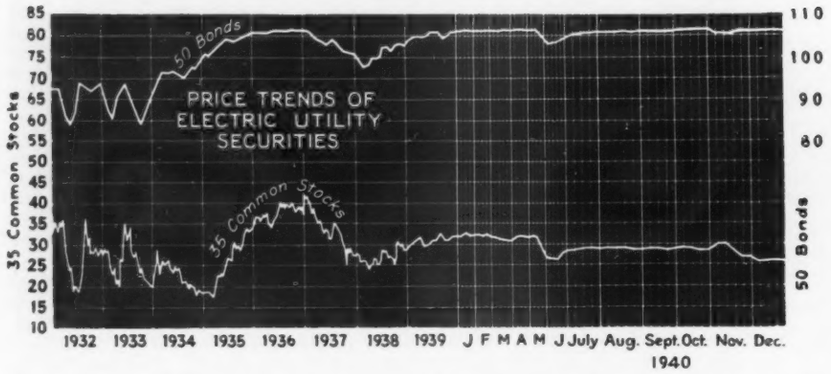
Duke Power Co. plans expenditure of from $500,000 to $750,000 for construction of a new transmission line between Winston-Salem and its Buck steam plant on the Yadkin River, near Spencer, N. C.

•

Electric Sales Up 7.9%

Total sales of energy to ultimate consumers by the eleven largest electric utilities in the state of Illinois amounted to 719,862,170 kw.-hr. in November, 1940, as compared with 667,049,893 kw.-hr. reported for the same month last year. This is a 7.9 per cent increase. Comparison of November's sales with those for October, 1940, reveals an increase of 3.8 per cent.

Securities Move Within Narrow Range


50 Bonds
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
35 Common Stocks
35 Common Stocks
50 Bonds
1932 1933 1934 1935 1936 1937 1938 1939 J F M A M J July Aug. Sept. Oct. Nov. Dec. 1940

Fluctuations in the prices of electric light and power securities were slight during the past week. "Electrical World" stock and bond indices remained unchanged from the previous week—stocks at 26.7; last year, 31.5; bonds, 106.3; last year, 106.1

Utilities Register Pleas with SEC

Montana-Dakota Utilities Co. has filed a registration statement covering $2,500,000 of 2½ per cent first mortgage serial bonds, due May 1, 1942-49, and $7,500,000 of 3½ per cent first mortgage bonds, due January 1, 1961. Proceeds will be used for the redemption of outstanding bonds.

Monongahela West Penn Public Service Co. has filed a declaration regarding a proposal to borrow not more than $800,000 from the National City Bank of New York to be evidenced by promissory notes. The company proposes to use the funds for the construction of transmission lines and substations to supply electric energy to a plant to be constructed by E. I. duPont de Nemours & Co. at Morgantown, W. Va., for the manufacture of anhydrous ammonia for the government under the National Defense Program.

SEC has announced the filing of declarations regarding the proposed acquisition by Texas-New Mexico Utilities Co. from Southwestern Electric Co. of $20,600 principal amount of 5 per cent general mortgage bonds, Series A, of New Mexico Utilities Co., which have been assumed by Texas-New Mexico Utilities Co. The bonds are to be acquired for cash at the principal amount, plus accrued interest.

•

$13,391,000 Los Angeles Power Bonds Offered

A $13,391,000 offering of Department of Water and Power of the City of Los Angeles Electric Plant revenues bonds were recently issued. The bonds comprised two issues—$10,891,000 of 3 per cent, 2 per cent and 1¾ per cent refunding revenue bonds, second issue of 1940, and $2,500,000 of 1¾ per cent, 1½ per cent, 1¼ per cent and 1 per cent revenue bonds, third issue of 1940.

Electric plant refunding revenue bonds, second issue of 1940, were issued for refunding purposes and the revenue bonds, third issue of 1940, are for the purpose of providing funds with which to meet the cost of acquiring, constructing, extending and improving the electric works.

•

Issues Detroit Edison Bonds; Vote Dividend

Offering was made last week to the public of the $50,000,000 of general and refunding 3 per cent mortgage bonds, series H, of the Detroit Edison Co. The bonds, due on December 1, 1970, were priced at 107¼. All of the proceedings will be used for refunding. By reaching the public less than six days after the filing of the original registration statement, the issue set a record for speedy passage through the period of registration with the SEC.

A final dividend of $2 a share on the common stock for the year 1940 was voted by the company out of surplus and net profits. A similar payment was made in January, this year.

•

Plans $10,000,000 Issue

Montana-Dakota Utilities Co. has applied to the Federal Power Commission for authority to issue $10,000,000 of its first mortgage bonds, the net proceeds from the sale thereof to be applied to the redemption of an equal amount of first mortgage bonds now outstanding.

•

Sale Again Postponed

Sale at public auction of 712,411 shares of common stock of the Jersey Central Power & Light Co. has been postponed again until February 18, 1941.

Board Limits Issue of Utility Stock

New York Public Service Commission has, for a second time, refused to allow Central New York Power Corp. to sell sufficient additional bonds and stock to raise the amount of money the utility contends it needs to finance new construction and for more working capital.

The commission authorized Central New York Power to sell $5,000,000 of 3½ per cent general mortgage bonds, due 1965, to the Equitable Life Assurance Society at 101 not later than December 31, and 16,415.6 shares of 5 per cent preferred stock of $100 par value to its parent company, Niagara Hudson Power Corp., at par before November 1, 1941. The company's latest request was for permission to sell 38,877.6 additional shares of preferred stock as well as $5,000,000 of bonds.

This decision of the commission marks the second step in the proceeding. In July, the company asked permission to issue $6,000,000 of bonds and 105,263 additional shares of common stock at $28.50 a share to realize total proceeds of $9,059,996, but in September the commission authorized the utility to issue only $5,000,000 of bonds and made no authorization for issuance of common stock. The utility did not accept the September order, but amended its petition to ask for permission to issue $5,000,000 of bonds and 38,877.6 additional shares of 5 per cent preferred stock.

•

Freezes Debt Claims

A federal court restraining order preventing any change in a $4,786,000 debt claimed against Portland General Electric Co. by the Chase National Bank of New York and the Harris Trust and Savings Bank of Chicago has been ordered continued in effect until March 10, 1941, by Federal Judge James Alger Fee.

Utility Reports

	1940	1939
*American Power & Light and subs	$12,213,858	$10,142,588
*California Oregon Power	923,441	892,118
†Detroit Edison and subs.	10,446,719	9,809,489
*Key West Electric	45,048	39,372
*Mississippi Power & Light	409,501	515,018
*Nevada-California Elec. and subs.	453,645	352,579
*Nortwestern Electric	483,407	569,944
*Savannah Electric & Power	144,298	259,264
*Southern Colorado Power	211,012	264,823
*Superior Water, Light & Power	112,196	118,819
*Western Public Service and subs.	168,203	172,160

*Twelve months ended October 31.
†Twelve months ended November 30.

HERE'S WHAT YOU GET—
Completely Engineered
YOU probably have FH breakers on your system now. And you know how

YOU probably have FH breakers on your system now. And you know how General Electric has been building them into steel cubicles for more than six years. You also know how this construction saves installation time and cost, saves space, and provides the most reliable protection. As one engineer expresses it, with FH cubicles "the cables in and the cables out are all you have to worry about."

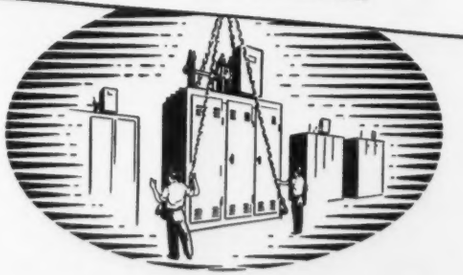
FH cubicles are available with either low-oil-content breakers or air-blast breakers.

Practically all of the FH breakers now being installed are shipped assembled in steel enclosures or cubicles. General Electric Company, Schenectady, New York.

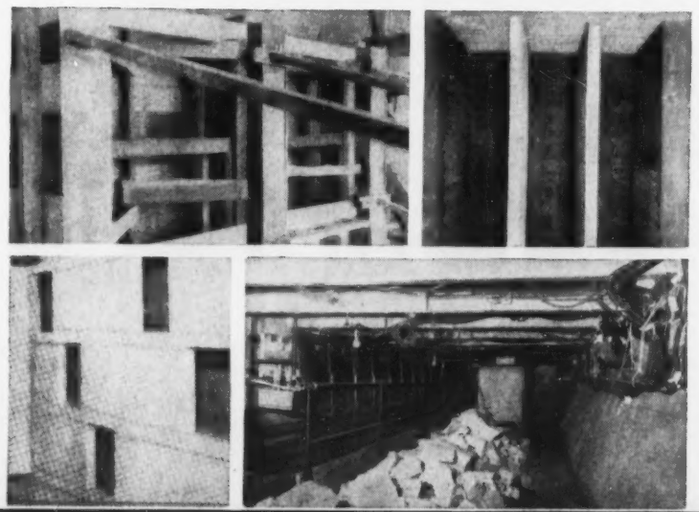
HERE'S WHAT YOU GET—

Completely Factory-assembled in a Steel Housing

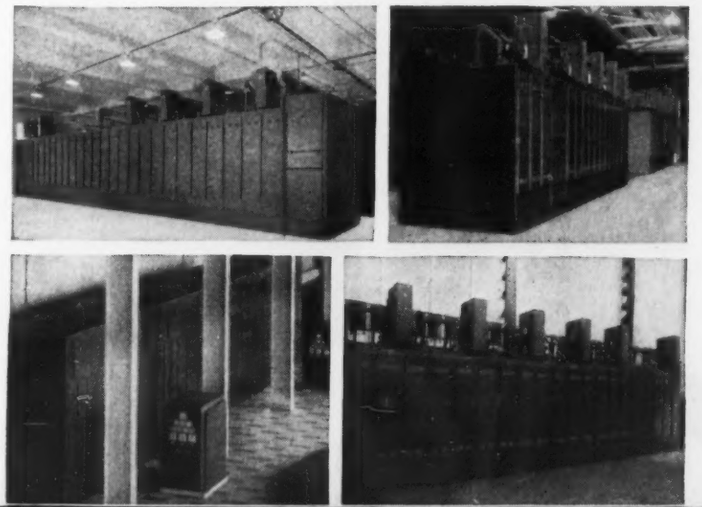
1. Modern low-oil-content or air-blast Type FH breakers, 500,000 to 2,500,000 kva
2. High-speed, trip-free breaker operating mechanism
3. Six group-operated, heavy-duty isolating disconnecting switches
4. Mechanical interlocks for breaker, switches, and doors to assure correct sequence of operation
5. Heavy-duty structural-shaped buses
6. Heavy-duty bus supports
7. Copper interconnections with silver-to-silver current-exchange surfaces
8. Necessary current transformers
9. Phases segregated with grounded steel



Say Good-by to Costly Masonry-cell Construction



The Old Concrete Problem Solved with Steel



GENERAL ELECTRIC

855-6

OPERATING PRACTICES

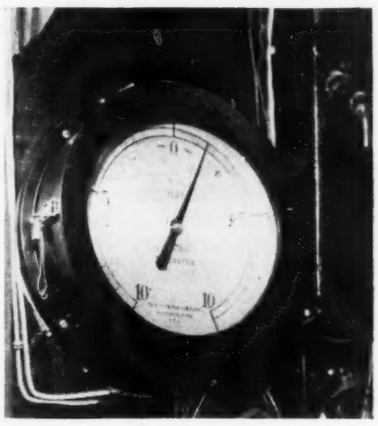
Telemeter Water Level Record

By REGINALD TRAUTSCHOLD
Caldwell, N. J.

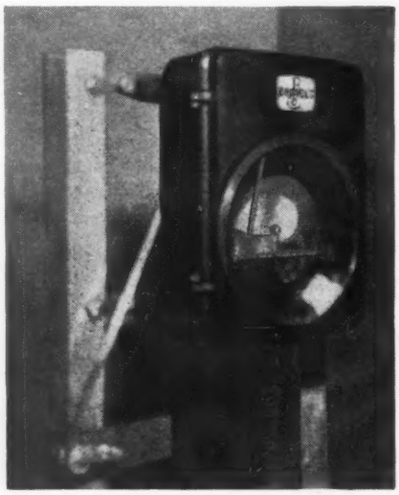
To keep the generating plant constantly informed in respect to the pressure head behind the miles of wood-stave pipe line bringing the water down from the dam to the power house, a distance of 3½ miles, and also afford an indication at the gate tender's house near the hydro station, the New England Power Company's hydro-electric station at Searsburg, Vt., has installed a telemetering system. An arrangement of filter circuits safeguards the telemetering line between the dam and the station against line surges due to electrical disturbances—permitting only the passage of the electrical impulses that post the true reservoir level on the slowly rotating chart of a telemetering receiver at the station.

At the gate house, right at the dam, a Bristol Metameter transmitter measures the water level as gauged by the pressure upon a submerged pressure-type bulb and constantly sends out proportionally timed, make-and-break electrical impulses over the telemetering circuit. The actuating magnets of the receiver at the gate tender's house and the recording receiver at the Searsburg station respond to these impulses, moving the pointer of the gate tender's instrument and the position of the recording pen on the rotating chart at the hydro station in conformity with the measurement of the water level.

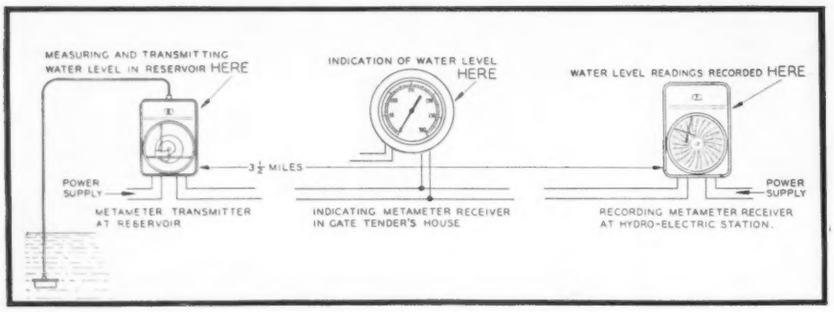
The telemetering circuit is a simple two-wire line carried on the same poles along the pipe line right-of-way that support the three-phase, 2,300-volt power main leading from the station to the dam and the connecting telephone lines. Thus the water level is indicated at the Searsburg station and the gate tender's house, the power necessary for gate manipulation and direct communication lines providing for needed water level regulation.



RECEIVER at operator's house



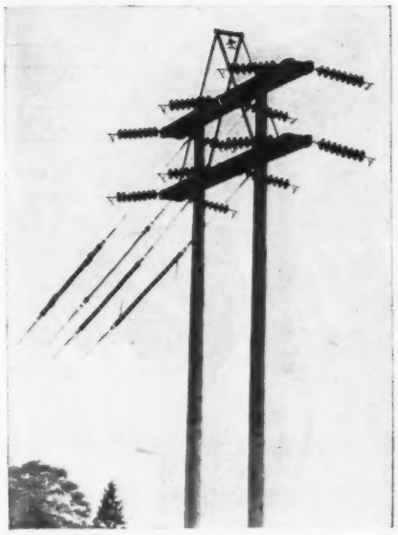
METAMETER transmitter in gate house


MEASURING AND TRANSMITTING WATER LEVEL IN RESERVOIR HERE
INDICATION OF WATER LEVEL HERE
WATER LEVEL READINGS RECORDED HERE
3½ MILES
POWER SUPPLY
METAMETER TRANSMITTER AT RESERVOIR
INDICATING METAMETER RECEIVER IN GATE TENDER'S HOUSE
RECORDING METAMETER RECEIVER AT HYDRO-ELECTRIC STATION.
POWER SUPPLY

WATER LEVEL indication for Searsburg station showing transmitter at gatehouse and receivers at gate tender's house and hydro-electric station

Rugged Support for Ground Wire

On a 22-kv. New England transmission line crossing a salt water inlet the problem of providing adequate support for the ground wire was effectively solved by carrying it on a single suspension insulator disk attached to the top of an angle-iron frame spanning the double crossarms of the double-pole structure employed to support the two circuits of the line. Each phase wire is terminated at a set of suspension insulator disks forming



DOUBLE-POLE UNIT surmounted by angle-iron frame for ground wire provides adequate clearance

a strain unit on each side of the double crossarm, one set of double arms being provided for each circuit.

Guy wires with wooden insulating sections and arcing horns to facilitate carrying lightning discharges to earth are provided at four points. The ground wire support used insures adequate clearance at all times and the general design of the structure involves minimum material and maximum clarity of circuit identification for both construction and maintenance purposes.

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Sodium Lighting for a Chicago Viaduct

By O. H. TAYLOR

Electrical Engineer Board of Local Improvements, City of Chicago

Rather steep grades on the approaches to Chicago's new $675,000 South Laramie Avenue viaduct, which extends for about 2,000 ft. over the tracks of the Chicago Great Western and the Baltimore & Ohio Chicago Terminal railroads, required special effort through lighting to obtain maximum safety. After careful consideration, curb end lighting, curb reflector markers and particularly sodium lighting were provided to attain this end.

Street-lighting equipment installed consists of nineteen lighting units with General Electric M-2 luminaires and 10,000-lumen type NA-9 sodium-vapor lamps, suspended from brackets 2 ft. inside the edge of the pavement and at a 25-ft. mounting height. The tapered, fluted steel poles are spaced 110 ft. apart, staggered.

Calculated average light intensity on the roadway is 0.614 lumen per sq.ft. or 27 lumen per lineal foot and meets the recommended practice of the Illuminating Engineering Society Code of Street Lighting.

Lights are connected in series to the city's standard 5,000-volt primary cable through insulating transformers mounted in handholes adjacent to each lighting standard. These transformers have 220-watt capacity with 10-amp. primaries and 6.6-amp. secondaries.

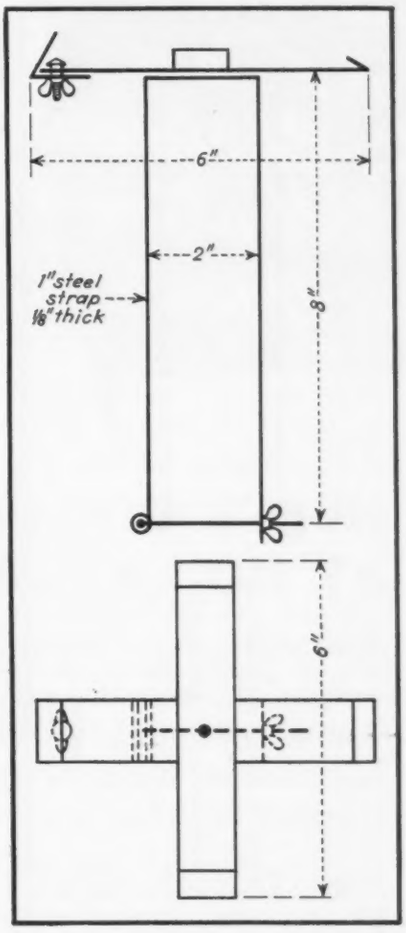
The four-lane roadway is 44 ft. wide and is divided by a concrete curb constructed of white cement with a black center marker for contrast. It extends within 160 ft. of the terminals of the improvement, at the ends of which markers, consisting of black precast blocks of cement, are inserted diagonally on a varying width in the pavement as warning of an obstruction ahead.

Each curb end contains a housing built into the concrete center curb in which there are three 60-watt flashing lights mounted behind three heavy Lucite windows on each side.

Bi-directional Stimsonite reflectors of crystal Lucite are mounted on the center curb on a 25-ft. spacing as an additional safety measure for driving over the viaduct in the dark.

The improvement was constructed under the direction of the Board of Local Improvements, M. F. Mulcahy, president; Arthur Engh, engineer of special improvements.

Barricade Fitting Has Many Uses

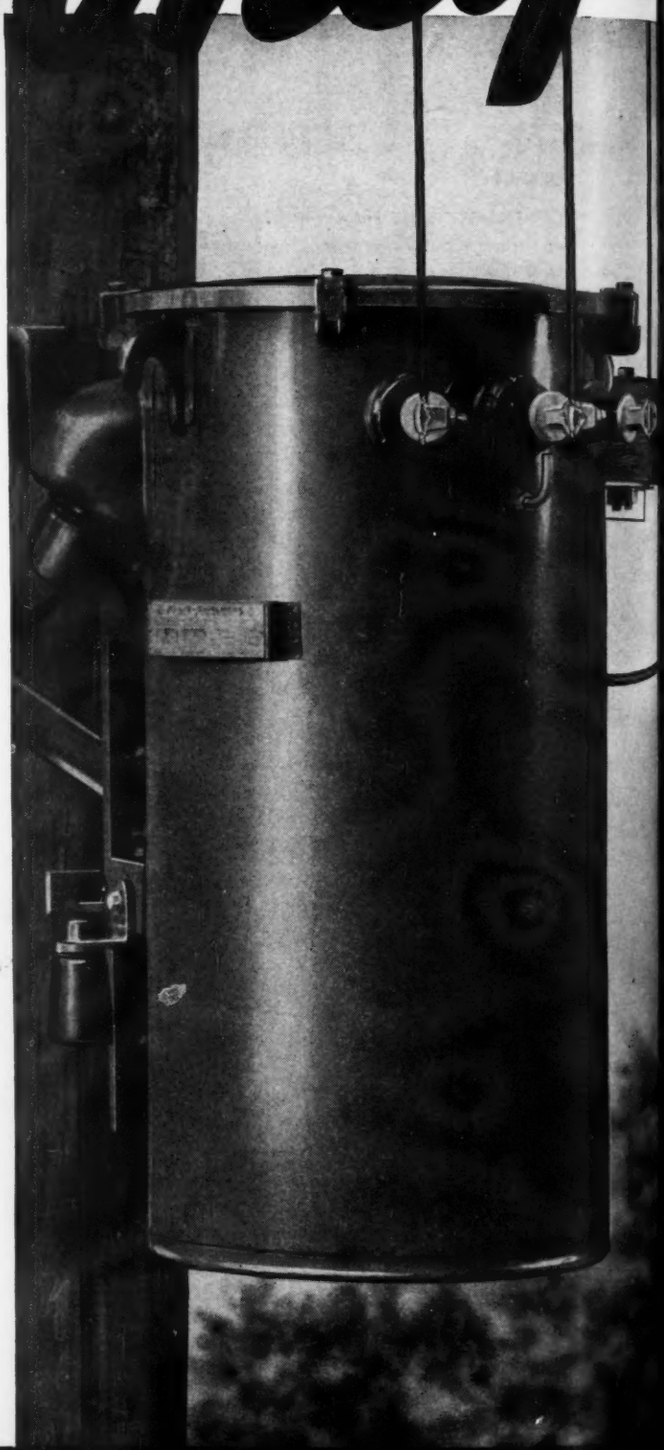


Variations of this barricade lantern holder are used to hold bullseyes for night work as well as station keys for a watchman's time clock on the system of the Dallas Power & Light Company. Sketch shows details of the lantern holder.

NINETEEN 10,000-lumen sodium-vapor lamps at a mounting height of 25 ft. and spaced 110 ft. staggered give 0.614 lumen per sq.ft. on Chicago's new Laramie Avenue viaduct

IT'S A Money

Quick Facts on the New Allis-Chalmers Distribution Transformer!



Here's Greater Value AT NO EXTRA COST!

1. Revolutionary Cadmium-plated 3-Way Terminal Cuts Installation Time... Simplifies Wiring Job... Minimizes Electrolytic Action on Copper or Aluminum Conductors.
2. New, Durable Steel Tank, Tested Under Pressure... Prevents Oil Leakage... Assures Long Life.
3. New Spra-bonderizing... Plus Triple Coat Automobile Finish... Gives Positive 4-Way Rust Protection.
4. Double Conductor Insulation Provides Double Safety Against Winding Failures.
5. Time-proven Core and Coil Construction... Designed for Years of Efficient, Service-free Operation.
6. Extra-heavy Porcelain Coordinated Bushings with Liberal Creepage... Offer Maximum Reliability Under Fog, Dust, Chemical, or Other Adverse Operating Conditions.

ALLIS-CHALMERS DISTRIBUTION T

-Saver ON THE POLE, AND ON YOUR POCKETBOOK, TOO!

EASY INSTALLATION . . . freedom from service interruptions . . . greater dependability — that's what Allis-Chalmers engineers were shooting at when they designed the new Allis-Chalmers Distribution Transformer.

And the great engineering features they built into that transformer speak for themselves!

Notice how the big 3-Way Terminals are heavily coated with cadmium so they can be used with *both* aluminum and copper leads . . . how their simple, fool-proof construction points to big savings in installation time.

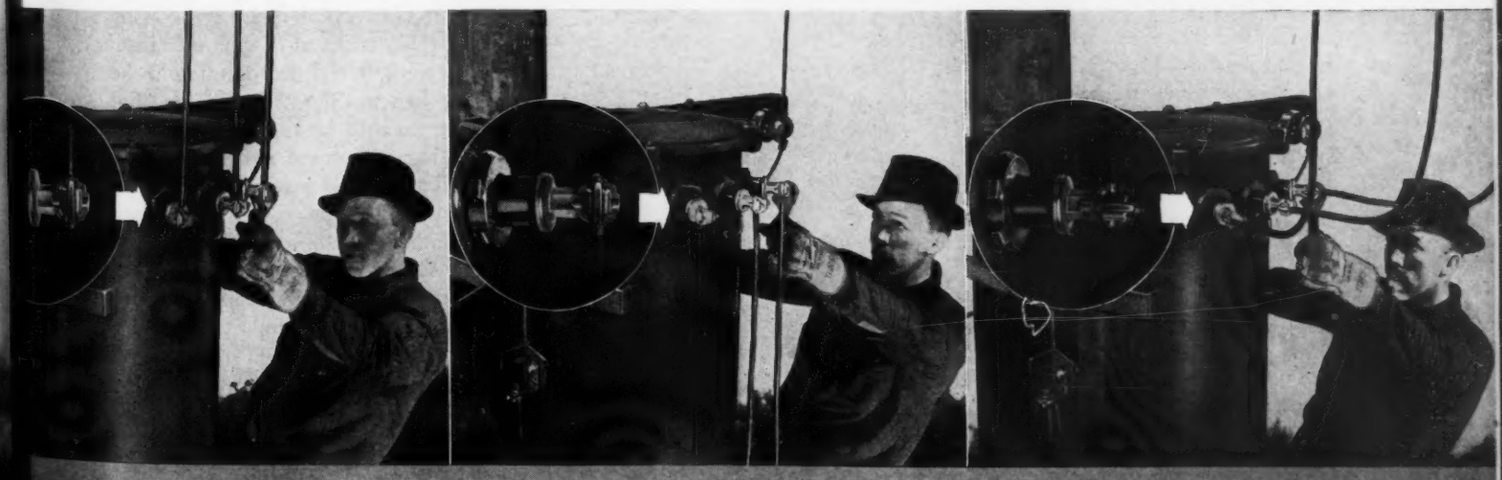
Take a close-up view of the husky steel tank. It's tested under pressure to eliminate oil leakage . . . and it's bonderized and given a triple coat automobile finish for positive protection against rust.

For the inside story . . . look in the tank! You'll find new coil perfection there . . . dictated by Allis-Chalmers' over 40 years of building distribution and power transformers for utilities throughout the world.

And you'll see that all windings are double insulated. That's for *added* safety and *double* protection against winding failure.

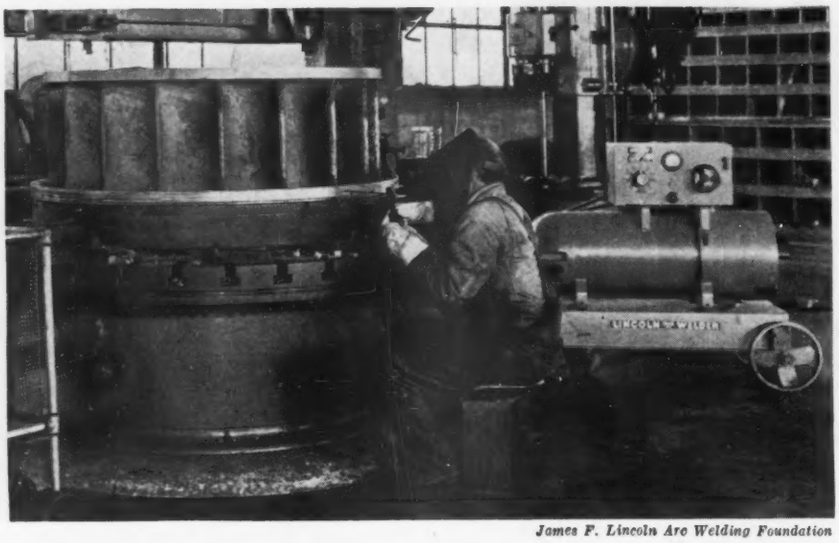
Then look at the price! You'll be surprised to find that this new Allis-Chalmers Distribution Transformer, with all its engineering advancements, costs no more than ordinary distribution transformers.

Learn the whole story of *all* the extra-value, cost-cutting features you get in the new Allis-Chalmers Distribution Transformer. Call the nearest Allis-Chalmers district office or write for new Bulletin B-6096, Pittsburgh Works, Allis-Chalmers Mfg. Company. A-1235



SEE HOW THE NEW 3-WAY TERMINAL WORKS! First and second pictures show how simply and easily leads can be brought to the transformer from both top and bottom. But you don't stop there! For the third picture illustrates an ***extra*** advantage you get with no other terminal! If necessary, leads can be brought straight out from the transformer, without making an extra bend in the conductors or complicating the wiring job. Notice how the tightening tool travels in an ***up and down*** direction eliminating the chance for accidental shorts across the secondary terminals. Notice, too, that a standard lineman's wrench is used. No special tools are needed. You don't have to buy extra fittings. Heavy cadmium plating of the 3-Way Terminal makes it possible to be used with ***both*** copper and aluminum conductors with a minimum of electrolytic action.

N TRANSFORMERS *Cut Operating Costs*



James F. Lincoln Arc Welding Foundation

ARC WELDING builds new turbine seal rings on the job to provide time and cost savings over banding method

Build Turbine Seal Ring by Welding*

Savings of 62 per cent in costs and nineteen hours in time were achieved by building new seal rings directly on a 58-in. Francis type turbine by arc welding, rather than by rolling and machining a new band.

At the 50,000-hp. Don Pedro power plant of the Turlock Irrigation District, Turlock, Calif., the maintenance program requires that each year one of the five machines must be overhauled and put into new operating condition. Since this must be done between the end of the peak load season and before high water starts the time for making repairs is limited.

Electric welding is used to fill in the cavitated areas of the blades of the turbines. Seal rings have been replaced by rolling out new steel bands, machining them and then shrinking them onto the circumference of the runners. Machining is made difficult and costly by the small cross-section and large diameter of the steel bands.

When one of these rings was accidentally spoiled through an error in measurement on the boring mill and time was pressing for completion of the job because of threatening floodwaters, it was suggested that arc welding be tried. The experiment turned out so successfully that it was decided to study costs and see if this method of manufacturing seal rings on the job by applying beads of welding on the old base without removing the rings from the waterwheels might be desirable for future jobs.

For the old method of rolling a band, machining the inner surface, shrinking the band onto the runner and then machining the outer surface the material cost was $4.34 per ring and the labor cost was $76.25, making a total cost of $80.59.

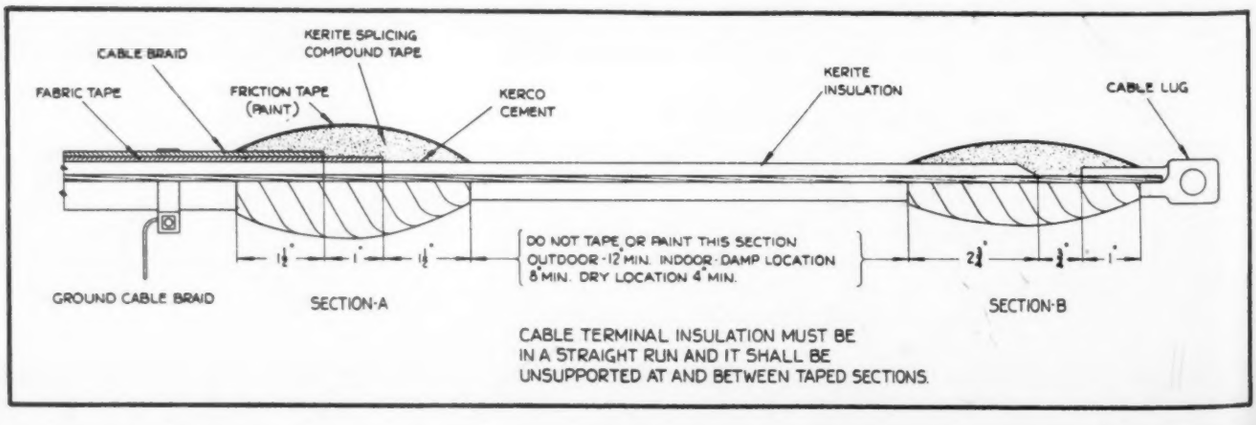
For the new method of running six beads of welding around the periphery of the wheel the material cost was $2.07 per ring and the labor cost was $28.75, making a total cost of $30.82 —a saving of $49.77 or 62 per cent.

Time savings are realized because less metal has to be cut away using the new method. Only a small excess of metal is applied by the welder and he can confine the build-up metal to the area he wishes. In machining new rings a large excess of stock metal had to be used in order to have sufficient stiffness to stand machining prior to being shrunk on the waterwheel. This excess material then had to be machined away.

*Data and illustration from award study submitted to the James F. Lincoln Arc Welding Foundation by L. H. Parker, electrical engineer, and F. G. Stagg, welder, Turlock Irrigation District, Turlock, Calif.

Insulating and Sealing Cable Ends

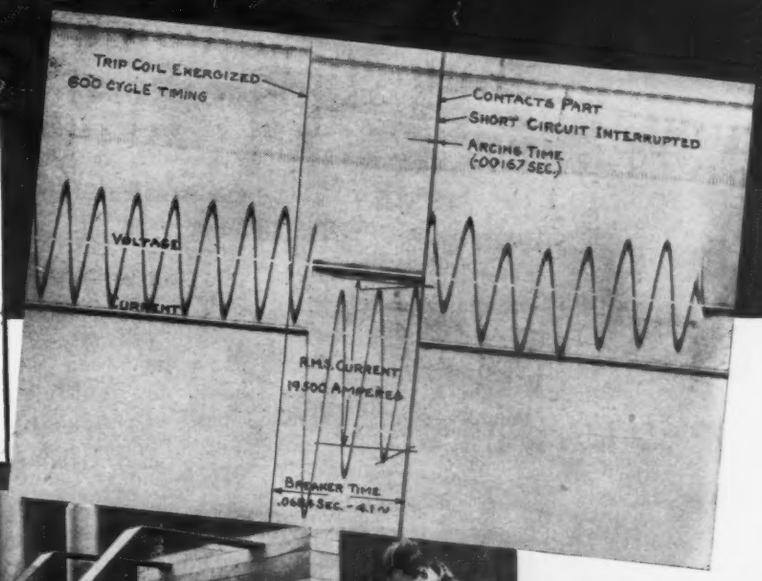
As shown in the illustration below, the distribution specifications of the West Penn Power Company for insulating and sealing ends of 2,300-4,600-volt cable require that the cable extend at least 3 ft. beyond end of duct before applying tape over braid at section A. Cable and taping at section B may be omitted if a weatherproof connection can be made in a box type cutout or disconnect; insulation shall extend through hole in box. Roughen braid and insulation slightly at area to be taped, apply a light coating of cement and allow to dry until tacky, then wrap with splicing compound tape. Keep insulation clean between taped sections. Do not put cement or any form of paint between layers of splicing compound tape. Stretch this tape to three-quarters of its original width in applying.


CABLE BRAID
KERITE SPLICING COMPOUND TAPE
FABRIC TAPE
FRICTION TAPE (PAINT)
KERCO CEMENT
KERITE INSULATION
CABLE LUG
DO NOT TAPE OR PAINT THIS SECTION
OUTDOOR-12" MIN. INDOOR-DAMP LOCATION 8" MIN. DRY LOCATION 4" MIN.
GROUND CABLE BRAID
SECTION-A
SECTION-B
CABLE TERMINAL INSULATION MUST BE IN A STRAIGHT RUN AND IT SHALL BE UNSUPPORTED AT AND BETWEEN TAPED SECTIONS.

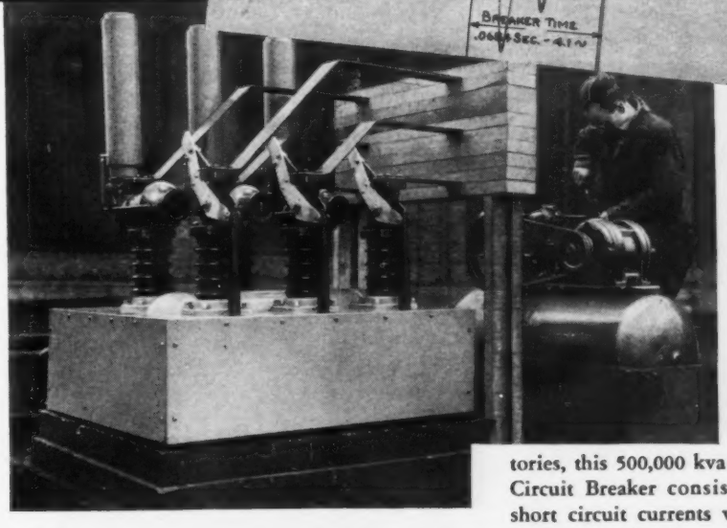
LIFE HISTORY OF AN ARC--

.00167 Seconds!

Split Cycle Speed of New Allis-Chalmers Air Blast Circuit Breaker Sets New Records for Interrupting and Arcing Times! Read How You Can Cut Your Maintenance and Inspection Costs . . . Maintain Customer Good-Will.



SPLIT-cycle arcing time (1/600 of a second) is shown on the oscillograph of an Air Blast Breaker interrupting 429,000 kva at 11 kv.



ON ITS way to the testing laboratories, this 500,000 kva Allis-Chalmers Air Blast Circuit Breaker consistently interrupted heavy short circuit currents with arcing times of less than one-half cycle.

If you want arcs cleared positively and quickly . . . if you want shorter interrupting and arcing times . . . if you want to cut inspection and maintenance costs — this life history of an arc (only 0.00167 seconds) is important reading for you!

Think of it! Arcs actually extinguished in *1/600 of a second!* And that performance indicates what you can expect from the new Allis-Chalmers Air Blast Circuit Breaker . . the split cycle speed that saves you money!

Here's how it's done! By using the dynamic, dielectric and cooling effects of compressed air, these new breakers get into action *fast* . . . literally *blow out* arcs. And they do it so efficiently that arcing times of less than one-half cycle are consistently obtained.

The same compressed air also supplies energy for contact operation. And the faster operating times give you faster reclosings . . . increased customer good-will.

What's more, the automatic insertion of paralleling resistors dampens high frequency transients . . . improves your power factor . . . limits the magnitude and rate of rise of recovery voltage during arc interruption.

To get complete information on the cost-cutting features of the new Allis-Chalmers Air Blast Circuit Breaker, call the district office near you. Or write direct to Allis-Chalmers, Milwaukee, Wisconsin. A 1266

Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

INDUSTRIAL ENGINEERING

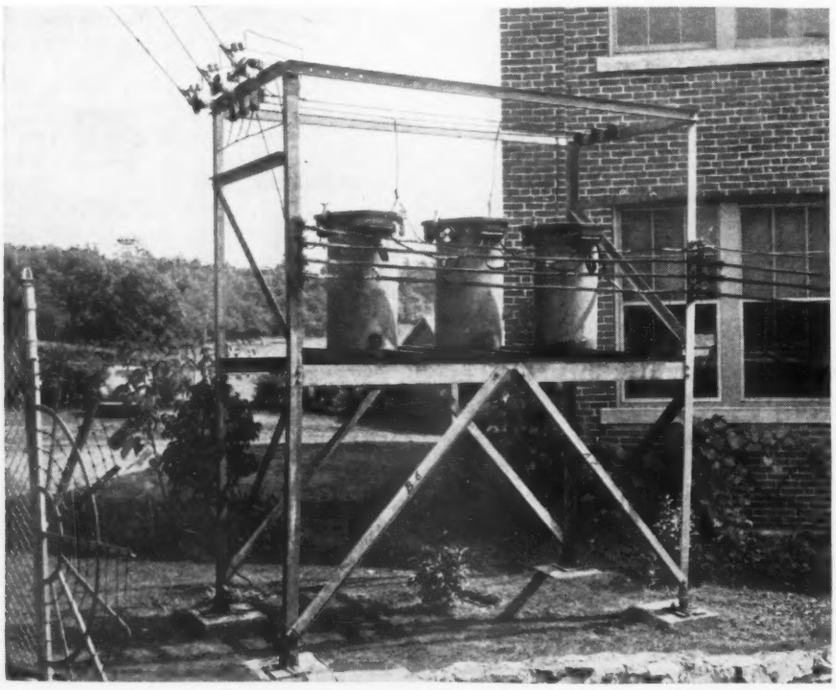
Factory Substation of Simple Design

Economical use of material combined with the isolation of primary wiring has been attained in an industrial transformer substation serving the Mayflower Worsted Company, Kingston, Mass. Three 37.5-kva. transformers mounted on a structural steel frame set in concrete piers and carried about 12 ft. above the ground provide for a clear-cut separation of primary and secondary circuits, using strain insulators at the primary downtake and spool type insulators and brackets to carry the secondaries.

Vertical members are 3-in. angles with 2 x 3-in. angles for diagonal bracing; 5-in. channel irons are used for main horizontal supports of the transformer group, with two 3-in. I-beams per transformer. The top of the structure is of 2.5-in. channel iron, 10 ft. long x 5 ft. wide. The transformers are carried about 6 ft. above the ground, with clearance well above any probable flood level, or chance of personal contact, and have a radial barbed wire guard at a highway boundary facing the substation yard.

This arrangement provides for a separation of primary and secondary wiring for maximum operating safety and a clear-cut progression of energy from the outside pole into the factory, with no chance of mistaking connections. Wire was saved by short taps from the incoming primary to the horizontal buses in the upper section of the structure, and thence to the transformer bushings. Direct secondary taps were also made to the horizontal conductors racked on insulators along the outside of the structure and leading into the mill.

Short taps were also provided from the lightning arresters to a wire ground bus between vertical members as shown, in addition to a ground lead from the structure into a small stream below.



STANDARD structural members isolate transformers against casual contact

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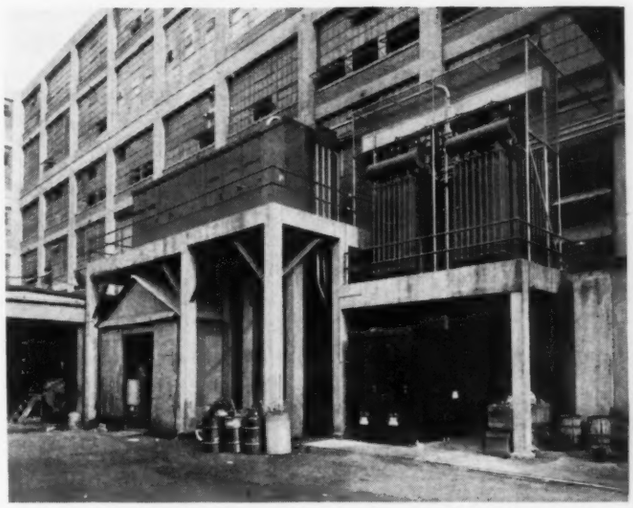
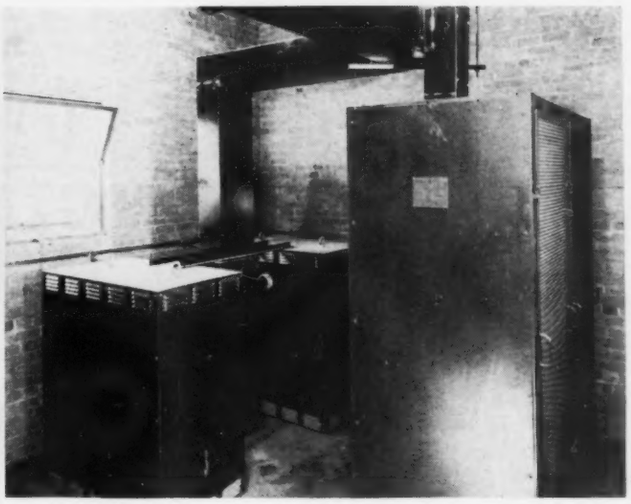
Floodproofing a Power Supply

Space inside factory buildings is released for production and the operation of control equipment and transformers safeguarded against high river stages at the Colt Patent Fire Arms Manufacturing Company plant in Hartford, Conn., by the recently completed construction illustrated herewith. The cubicles containing various metering, control and local feeder equipment are mounted on a 33x15-ft. reinforced concrete platform about 25 ft. above the ground level and two 1,000-kva. power transformers on a similar platform at the right are now located with a net increase in height to bushings of 16 ft. above the former level. The main platform is provided with a railed walkway 3 ft. 6 in. wide and piers, leaving the ground space free for other use, while below the transformers are further cubicles controlling other local power supply. The in-



TRANSFORMERS and cubicles on reinforced concrete platform clear previous flood stage by liberal margin



LOCATION of auto-transformers and capacitors in elevated fireproof chamber conserves factory space

coming connections are at 11 kv., three-phase, while the motor drives are generally at 220 volts, two-phase, a step-up to four hundred and sixty volts through auto-transformers being provided to connect with capacitors located at various points for power-factor correction. A 4-ft. space is available between cubicles and factory wall.

High-voltage connections to the cubicles are made by 350,000-circ. mil conductors carried in single phases in 2½-in. brass conduit, with similar connections to the transformer bank shown.

Capacitors and auto-transformers are located in a fireproof chamber adjacent to the cubicles on the upper platform. These equipment circuits are carried in an 8x12-in. duct of ¼-in. stock, welded, as shown in the upper part of the chamber, and suspended by 2-in. channel irons hung from the ceiling by ⅜-in. rods. The ducts are 7 ft. above the floor and carry 750,000-circ.mil connections to the auto-transformers and capacitors, 510 kva. being initially installed with space for 540 kva. At the auto-transformers the duct is supported by 1½x ¼-in. angles.

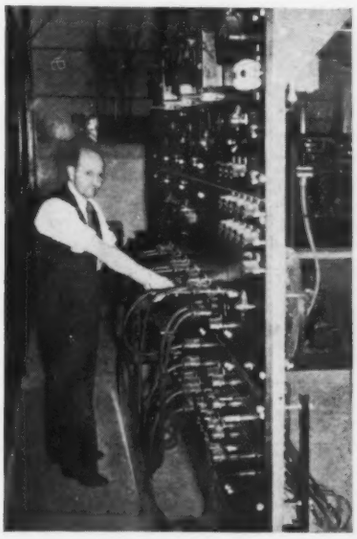
•

Flexible Power Panel for Relay Test

For convenience in the production testing of relays and motor-starting controls manufactured at the new factory of the Square D Company in Milwaukee a new bench panel has been devised that combines features of a plug board and multi-voltage test panel.

Principal use of the panel, shown, is to provide a means of checking relay operation at rated voltage and at 15 per cent below rated voltage. A 2-kw., air-cooled transformer with tapped secondary windings is mounted under the test bench and from it leads are brought up to four selector switches to be seen on the panel. These can be set to the desired nominal and "low" voltage. Nominal voltages of 600, 550, 440, 220, 208, 110 and 24 are available on the second and fourth selector switches (from the left) and the corresponding "low" voltages of 510, 467, 374, 187, 177, 93 and 20, respectively, can be obtained on the first and third. With the desired normal and low voltages selected they are applied to the control under test by operating the double-pole, double-throw switch at the top of the panel.

Two 110 and two 220-volt outlets are also available on the panel, as are two heavy-duty outlets which connect with a main plug board in another part of the plant. By various arrangements of the armature and field circuits of d.c. generators any d.c. voltage from 0–600 can be made available at any production test bench in the plant. Corresponding manipulation of d.c. motor-driven alternators make an a.c. available of frequencies from 25 to 180 cycles and voltages from 0–600.



BENCH-MOUNTED PANEL (left) for making production checks on relays provides nominal and 15 per cent low voltage in seven steps from 24 to 600; also provides outlet for special frequencies and d.c. voltages set up at main plug board (right)

NEW ENGINEERING IDEAS

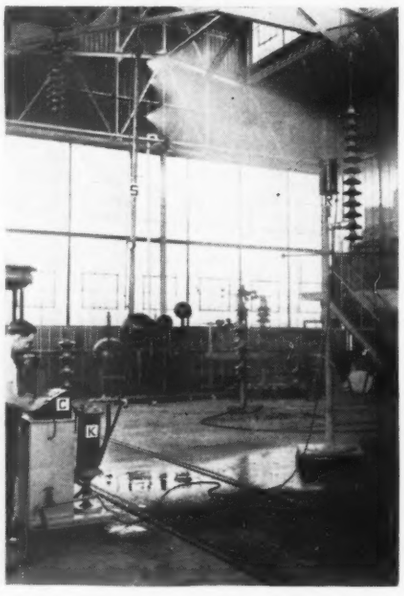
Measured Rainfall for Insulator Tests

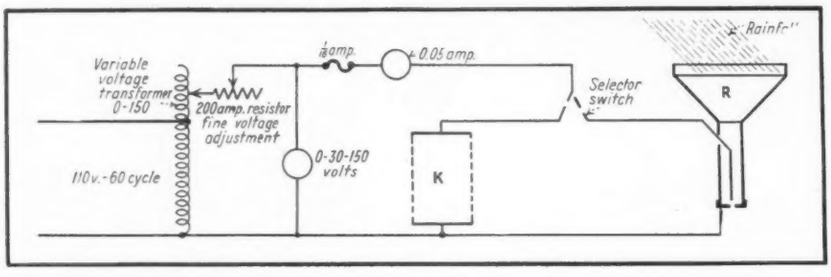
By PAUL M. ROSS
Superintendent, High-Voltage Laboratory, Ohio Brass Company, Mansfield, Ohio

To provide a continuous indication of the rate of precipitation as well as water resistivity used in artificial rain applied to insulators and other equipment when they are undergoing high-voltage tests the Ohio Brass Company has developed a continuously indicating electrical gauge. It consists of two principal elements, one for the rate of precipitation measurement and the other for the water resistivity measurement.

Water resistivity measuring-element "K" consists of a porcelain tube with metal end caps and fine mesh screens placed against the tube ends. The length of the tube in inches is numerically equal to its cross-sectional area in square inches. These physical dimensions cause the distance "K" between the end cap screens, determined by applying a voltage E_k and reading a current I_k, to be exactly the water resistivity in ohms per inch cube.

The rainfall rate of precipitation gauge "R" consists of a 10-in. diameter catch funnel with a 2-in. sharp-edged vertical rim into which the spray is directed. The discharge end of the funnel empties into an outer copper tube, at the lower end of which a disk with a drilled orifice is located. For any particular rate of precipitation the orifice causes a static head of water to rise in the outer tube so that at equilibrium the rate of discharge from the orifice equals the rate of catch in the funnel. The greater the rate of catch the higher the static head of water extends upward in the tube.





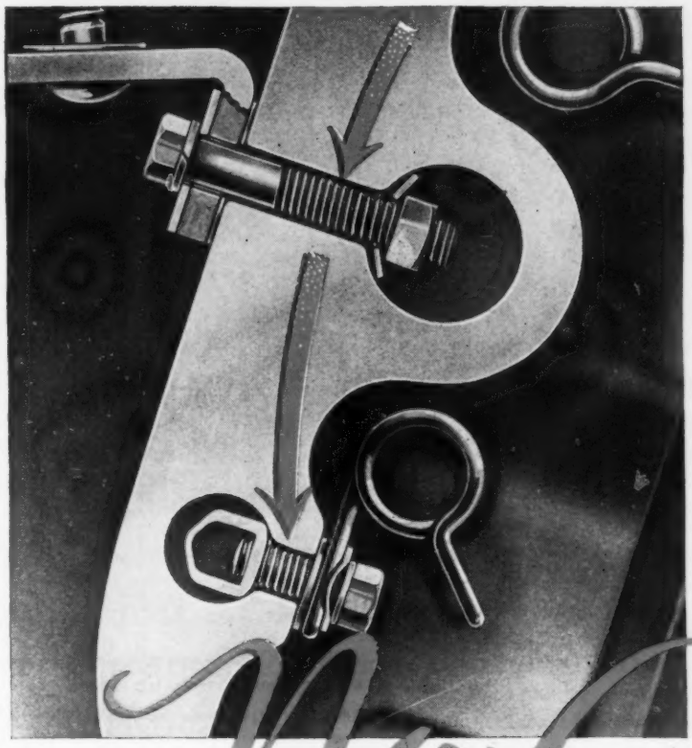
INSULATOR-RAIN VOLUME measured electrically

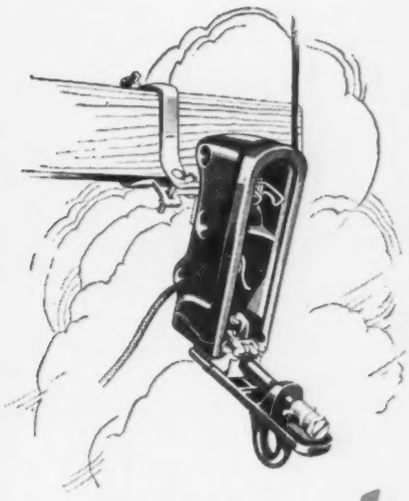
Schematic drawing of electrical circuit and (above) the apparatus in use, showing precipitation gauge "R," resistivity gauge "K" and instrument table "C" in use for determining the rate of water precipitation and resistivity as applied to a twelve-unit string of suspension insulators prior to wet flashover tests. The hydraulic circuit is arranged to pump water under pressure through "K" to the spray nozzles. The spray is directed from the nozzles toward the test specimen. Gauge "R" is placed in the spray immediately in front of the specimen to be tested.

Concentrically inserted in the water tube is a small diameter inner electrode. This electrode extends from the upper part of the tube to within one-half inch of the orifice disk. Two disks have been selected. Both are 0.005 in. thick and made of phosphor bronze, with rates of precipitation of 0.06 to 0.14 and 0.14 to 0.26 in. per minute. The inner electrode is electrically insulated from the outer electrode tube and supported by insulating blocks. A splash skirt is fitted over the lower funnel assembly so as to keep the insulating blocks dry. When a voltage E_r is applied between the inner and outer electrodes a current I_r is measured. The computed resistance r is directly a function of the resistivity of the water in the tube. Since the resistance is inversely a function of the height of the water in the tube it is inversely a function of the rate of precipitation falling in the catch funnel. When the resistivity k, in ohms per inch cube, is divided by the resistance r in ohms a function θ is derived, which is directly a function of the rate of precipitation. The design constants of the precipitation gauge are eliminated by direct calibration.

A graphical method can be prepared for the conversion of the above voltage and current readings into values of θ which can be directly calibrated in terms of "inches-per-

FROM THE ENGINEERING DEPT.—JAMES R. KEARNEY CORPORATION





The Tripomatic Fuse Cutout
5,000 to 7,500/12,500 Y Grd. Volt
50 and 100 Amp.

No Cement

IF metal parts, including hangers, were cemented to the porcelain housings of Kearney Tripomatics, would that be a source of unnecessary trouble — and perhaps costly outages? Would the use of cement be a source of radio interference?

Eliminate cement in Kearney Tripomatics — that was the decision after Kearney Engineers had carefully considered the question of its use.

And why? Well, according to general information, cement has characteristics known as "growing or shrinking." Some operating men, who were consulted, pointed out that cement might check, crack and absorb moisture — freeze, expand or contract.

But now — if cement was not to be used — how should parts be attached to the porcelain housings of Kearney Tripomatics? . . . And the answer — the development of a special washer which compensates for expansion and contraction — permits upper and lower contacts, as well as hangers, to be securely bolted to porcelain. Trunnions for hinging the door to the housing are securely anchored in the porcelain with type metal — again eliminating use of cement.

And that's just another of the engineering refinements which has been incorporated in the design of Kearney Tripomatics. Another reason why you'll find these Tripomatics giving years of dependable, trouble-free service.

JAMES R. KEARNEY CORPORATION
4236 Clayton Ave., St. Louis, Mo.
Canadian Plant - Toronto, Canada.

Use **KEARNEY PRODUCTS**

FOR **BETTER** MAINTENANCE and CONSTRUCTION

minute" rates of precipitation for each orifice. Successive calibration of the orifices using water resistivities of 4,000 to 8,000 ohms per inch cube should fall within 3 per cent of average curves.

•

Welding Makes Lighter Pipe Saddles

By developing a steel pipe saddle (see ELECTRICAL WORLD, December 30, 1939) which is fabricated by means of welding, Utah Power & Light Company has been able to effect substantial savings in the amount of material used, thus reducing the weight and the cost of transportation, handling and installing; 625 such saddles are in use on a new section of 11-ft. wood pipe and have proved satisfactory.

These welded, fabricated-steel saddles have been made in two ways. In one case a length of T-section was bent into a semi-circle to form the flange which bears on the pipe. Other structural shapes were used for the outer members.

Equally good in service, but apparently somewhat simpler to produce, is the type shown in the accompanying illustrations. In this case $\frac{5}{8}$-in. and $\frac{3}{8}$-in. flanges are welded onto a $\frac{1}{4}$-in. web as shown. The completed saddle weighs 750 lb.

•

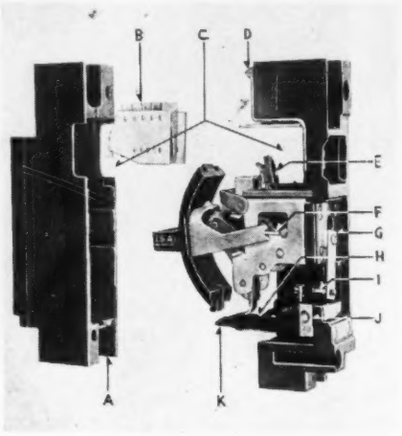
Ambient Compensated Thermal-Trip Breaker

For use in oil-immersed lighting panelboards, installed in locations exposed to corrosive elements and explosion-hazardous atmospheres, a new thermal-trip branch circuit breaker which has nearly constant tripping characteristics regardless of temperature changes has recently been developed by Westinghouse. This feature has been achieved by introducing an independent compensating bimetal strip, mounted outside the breaker frame where it is surrounded by the insulating oil.

An oil-immersed unit mounted outdoors may be required to operate at any external temperature from 5 or 10 deg. F. to 130 deg. Under such conditions the rating of the breaker would vary as much as 25 per cent above or below normal, and ambient temperature is likely to be different from that at protective device.

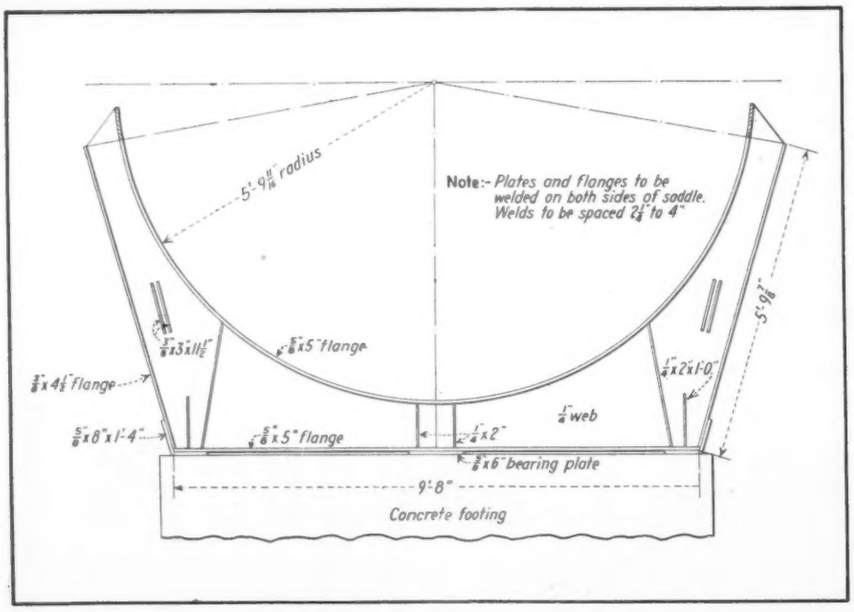
Since the compensating bimetal strip is mounted outside the breaker frame (instead of attached at the base), it is affected only by the temperature of the whole body of insulating oil. Motion of the compensating bimetal is transmitted to the tripping bimetal by a link of thermal and electrical insulating material passing through a small clearance opening in the wall of the breaker. This link shifts the tripping bimetal, the base of which is mounted on a pivot. The tripping bimetal is responsive both to ambient oil temperature and to current, while the compensating bimetal transmits just enough motion through the link to neutralize that part of the tripping bimetal's deflection caused by ambient oil temperature, leaving the net movement of the bimetal proportional to current only.

In commercial breakers of this type the compensating mechanism limits decreases in rating to 10 per cent or less at 140 deg. F. At lower temperatures the permissible variation is proportionately smaller, becoming zero at 75 deg., the temperature for which the unit is rated.



SINGLE-POLE, temperature-compensated, oil-immersed, thermal-trip breaker

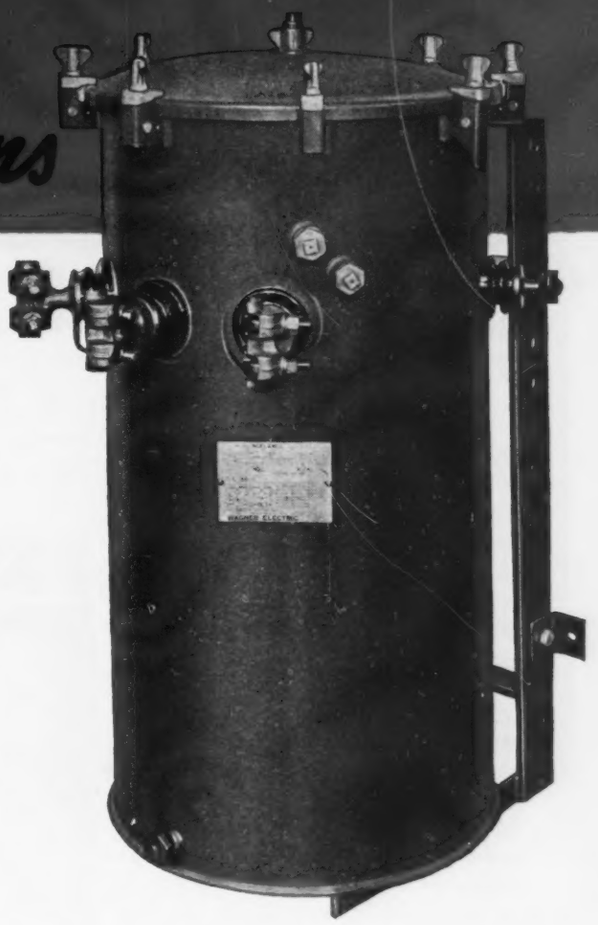
(A) Barrier for load terminal; (B) "De-ion" arc quencher; (C) opening in case prevents formation of excessive pressure on circuit interruption; (D) line terminal; (E) moving contact; (F) toggle mechanism; (G) compensating bimetal, mounted outside, deflection responsive to ambient oil temperature; (H) tripping bimetal, thermally lagged; (I) insulating link, transmits motion of compensating bimetal to tripping bimetal; (J) pivot for tripping bimetal; (K) free end of tripping bimetal, responsive to current only. Deflection caused by ambient temperature compensated by bimetal.



SIDE ELEVATION of welded steel saddle for 11-ft. wood-stave pipe. Saddles of the new design are being raised to position and aligned, ready for grouting

WAGNER NOFLAMOL NON-INFLAMMABLE LIQUID FILLED TRANSFORMERS

save money on transformer installations



NOFLAMOL is a non-inflammable, synthetic liquid developed as an improvement over regular transformer oil. It has all the desirable properties of the highest quality transformer oil plus the advantage of being safe to use in transformers that are installed in locations where regular oil-filled transformers would constitute a fire hazard.

Because of the non-inflammable characteristics of Noflamol, Wagner Noflamol transformers have these money saving advantages:

1. Wagner Noflamol-filled transformers can be installed indoors without the use of expensive fireproof vaults, because Noflamol is non-inflammable. Considerable installation expense is thereby avoided.

2. Savings are effected by dividing the circuit into several sections and placing a Wagner Noflamol transformer at the load center of each, eliminating long runs of secondary copper, reducing line losses and improving voltage regulation.

3. The only foundation necessary for the installation of Wagner Noflamol transformers is a level floor strong enough to support the weight.

4. Wagner Noflamol transformers can be installed in out-of-the-way places or on beams up near the ceiling, thereby releasing valuable floor space for other uses

SPECIFY WAGNER NOFLAMOL NON-INFLAMMABLE LIQUID FILLED TRANSFORMERS

T40-13

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS • MOTORS • FANS • BRAKES

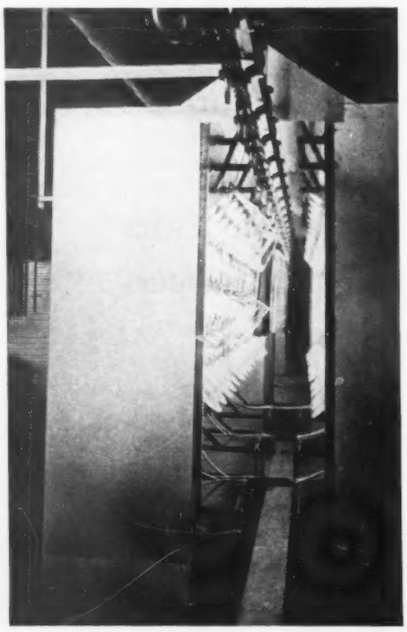
LOAD BUILDING

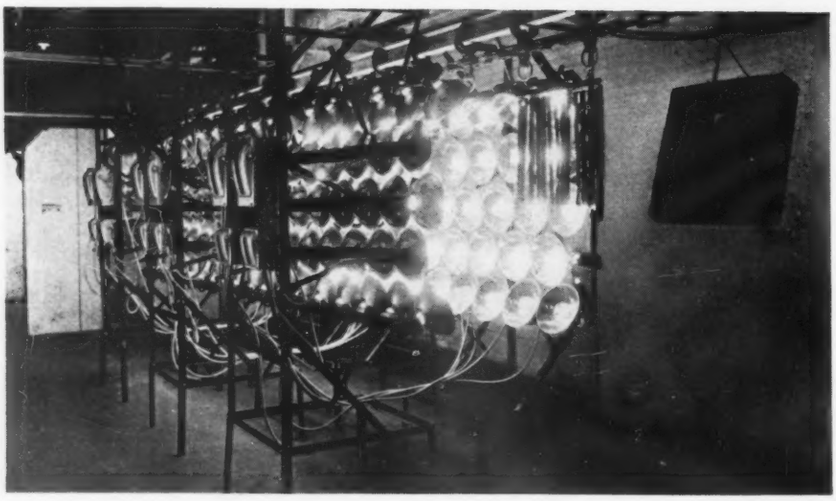
Infra-Red Tunnel Finishes Range Parts

Until recently, when an infra-red drying tunnel took over the job, some 50 Electromaster range parts not ordinarily protected by porcelain enameling or electroplating were processed in synthetic enamels by an outside organization or finished in air drying lacquer applied over a priming coat. With all these parts, such as drawer boxes, interior panels, interior brackets and base parts, now surfaced with synthetic enamel baked in the new 45-kw. infra-red tunnel the company notes an improved quality of finish and a reduced cost. It is estimated that the cost of the equipment will be paid for from operating economies in less than twelve months. Furthermore, the company is planning further application of infra-red and states that it will be pleased to act as a testimonial source for utility power salesmen.

Material from which the range parts are made is both hot and cold rolled steel, 11 to 24 gauge in thickness. The some fifty parts processed differ in dimensions, with 24 x 40-in. panels the largest pieces handled. The finish used is a specially prepared synthetic enamel which is used for dipping and spraying. Majority of the parts are finished in black; however, certain parts, such as drawer boxes, are finished in a semi-gloss aluminum. Either one or two coats are applied, depending upon the nature of their service.

The tunnel in which parts are baked consists of two facing banks of 240-watt carbon-filament lamps, 184 in all, in 10¼-in. gold plated reflectors closely spaced in five horizontal rows per bank. Distance from the filaments to work, as pieces pass through the tunnel, is approximately 16 in. Although the pieces per hour passing through the tunnel cannot be stated, due to the variation of sizes and types of parts finished, it may be stated that the time of each piece in the tunnel ranged from four to seven minutes, depending upon the weight and thickness of the metal.





ELECTROMASTER installs 45-kw. infra-red tunnel to bake synthetic enamel on drawer boxes, interior panels and other similar parts, installation to pay for itself from savings inside of twelve months

•

Evaluating a Home Service Program

How the cost of a home service program actively carried on by a private utility compares with its value to the company was analyzed by Ralph Gale, general sales manager Idaho Power Company, in a paper presented at the business development section meeting of the Northwest Electric Light and Power Association in Seattle.

Idaho Power's home service department consists of 22 trained young women working in a territory serving 52,000 residential and farm customers. Last year these home service

girls called on 18,000 customers. On each of these calls a sales presentation was made covering the present use of service; convincing the customer that she could not afford to decrease use of electrical service because of step-down rates; showing how Idaho Power was a desirable organization to be retailing electricity in their particular area.

A check-up on 500 customers indicated that such a call produced an increase of 4 kw.-hr. per month through more liberal use of electrical equipment in the home, a conservative estimate, according to Mr. Gale.

9,000 Calls Made

The department also made 9,000 calls consisting of complaint calls, lighting demonstrations, installation calls following purchase of new appliances and various other types of miscellaneous calls. It conducted more than 400 group demonstrations and meetings which more than 16,000 customers attended. These consisted of cooking schools, lectures and lighting demonstrations.

As a result of these 27,000 individual contacts and 400 demonstrations, home service girls sold $36,000 worth of lamps and small appliances.

Idaho Power Company found that the *cost* of carrying out this program for one year was $40,000. It decided to look into the *value* of this program.

The average monthly increase of 4 kw.-hr. for a one-year period would be worth 96 cents at 2 cents per kw.-hr. The company figured that it was worth 25 cents each to get the 16,000 customers to attend the group meetings. Follow-up on 1,500 complaints on cooking and laundry equipment on high service bills was easily worth $2.

During the year more than 2,000 complete lighting demonstrations were made in customers' homes. A value of $2 each was placed on these. Home service girls also made 2,600 calls on customers who had recently purchased new ranges and ironers. They assisted these buyers in learning the proper use and care of their new appliances. The company estimated that these calls were also worth $2 each.

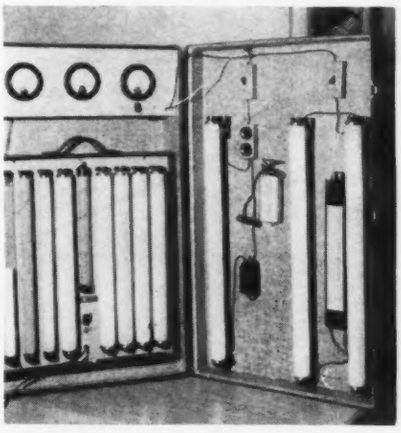
A credit of 20 per cent gross profit on the sales of $36,000 of lamps and small appliances was given to the home service group, which totaled $7,000. Tangible values which the company had received for one year from the home service department thus amounted to:

18,000 calls—48 kw.-hr. at 2 cents	$17,000
16,000 group contacts at 25 cents	4,000
1,500 complaint calls at $2	3,000
2,000 lighting demonstrations at $2	4,000
2,600 installation calls at $2	5,000
$36,000 sales—20 per cent profit	7,000
Total tangible value	$40,000

•

Explain Power Factor With Portable Kit

Until recently lighting salesmen of the Public Service Company of Oklahoma have been experiencing some trouble in getting the average customer to understand the effect of low power factor and, accordingly, to perceive the benefits of power-factor correction for fluorescent lamps. The illustrated demonstration kit, assembled in the company's lighting laboratory for their use, shows what takes place when power factor is corrected and has made the job of explanation much easier. With a firm concept established in the customer's mind through use of the kit, the salesman can proceed with his discussion of benefits on a sound basis.



SALESMEN use portable kit to show customer benefits of fluorescent power factor correction

The kit that the Tulsa salesmen use is housed in a conventional suitcase for portability. Besides a standard G. E. bank of display lamps showing available colors, the case contains a small instrument panel on which is mounted (1) a.c. voltmeter, 0–150 volts; (2) a.c. wattmeter, 0–75 watts, and (3) a.c. millimeter 0–500 ma. In the other half of the case are three 20-watt, 24-in. T-12 daylight fluorescent lamps. One of the three lamps is arranged with a single lamp ballast and has an ordinary duplex plug receptacle in the circuit so that a 4.75-mfd. shunt capacitor can be inserted in the circuit at will. The remaining two lamps are installed with a high power-factor Tulamp ballast. The instruments can be inserted in either one of these circuits as desired.

In demonstrating the effect of low power factor the single lamp is operated without the capacitor installed. With supply voltage 120 and the wattage reading 24–25, total current drawn by the lamp is noted as about 370 ma. However, when the capacitor is inserted in the circuit, current drops to 230 ma., with no noticeable change in either wattage or supply voltage.

•

Phone Calls Develop Industrial Business

That there is more to a direct mail advertising campaign than simply dropping the pieces into a mailbox and then waiting for returns has been demonstrated by a recent experience of Pacific Gas & Electric Company's commercial department. In this instance a telephone follow-up turned what had the surface appearance of an unsuccessful promotional program into a real success. As recounted by H. N. Carroll, manager of commercial and industrial electric sales, here is what happened:

Two comprehensive mailing pieces describing a new industrial electrical application which were supplied by one of the national manufacturers were sent to a list of 530 industrial customers in the San Francisco area at 60-day intervals. Each carried with it a postpaid return card carrying the usual request to have a salesman call and explain the proposal in greater detail. The number of returned cards was negligible and the campaign was about to be written off as a failure when a power salesman suggested that typical customers be called by telephone to determine why there seemed to be no interest. Results were surprising—one-fourth of the customers were interested.

A total of 490 telephone calls was made and 126 prospects developed. Within a short period 35 installations were sold and at this writing 45 of the other prospects were still in the negotiating stage, with every likelihood that they also would purchase.

NEW EQUIPMENT

Circuit Breaker

Arc quenchers developed for this improved circuit breaker have magnetic vanes molded into the insulating barriers on each side of the main contacts. They are mag-

Type "LX" circuit breaker; illustrated unit, with one arc quencher removed, is three-pole device equipped with three direct-acting overload and inverse time delay features, trip-free of handle; breaker ratings range from 100 to 1,600 amp., 250 volts d.c., 600 volts a.c. **I-T-E Circuit Breaker Co.**, Philadelphia, Pa.

netized upon opening of the arcing contacts and the field set up by the current forces the arc into the extinguisher chamber. In this chamber thick copper plates are arranged to cool the arc, create a turbulent gas condition and provide a cooling draft across the arc core. While a change has been made in the arcing contacts from carbon to metallic—elkonite—tips, the arrangement is similar to the standard carbon structure.

•

Electric Furnace

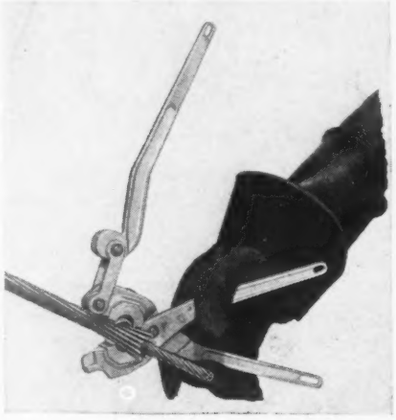
"Despatch" furnace for heat treatment of aluminum and magnesium alloys. **Despatch Oven Co.**, Minneapolis, Minn.

Reduction in time for the processing cycle is claimed for this new furnace for the heat treatment of aluminum and magnesium alloys. On preheating of the load and furnace the full 100 kw. is required for the first two hours. After this time the consumption per hour tapers off to approximately 25 or 30 kw. per hour during the stoking period. Practically 100 per cent recirculation is used with the furnace. There are eight thermocouples, four mounted on each sidewall, and by means of a multiple selector switch interior uniformity of the furnace can be checked at any time. Interior uniformity of the furnace is 5 deg. F. plus or minus when operating at 950 deg. F.; this is accomplished by oversized, large volume, high-static pressure fans. Air velocity through the furnace exceeds 20 miles per hour, the company states.

•

Armor Rod Wrench

Installing armor rods over aluminum conductors with this new method consists simply in slipping an armor rod clip into the wrench and fastening the clip firmly around the rods by pressure of the wrench. A snug-fitting one-piece clamp with no protruding parts results, it is stated, which may be removed quickly with a screwdriver. The clips also prevent distortion



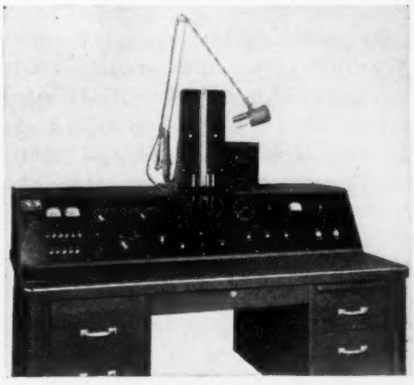
"D&J" armor rod wrench and clips; clips come in different sizes to fit various wire sizes; one wrench and four dies accommodate all sizes of clips. **Line Material Co.**, Milwaukee, Wis.

of the cable and eliminate possibility of corona discharge, according to the company.

BUYING ELECTRICAL EQUIPMENT?—"Electrical World" *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Meter Test Table

Facilities are provided on this combination meter test table for using the stroboscopic method for testing watt-hour meters marked for stroboscopic test and for using



Form "FRS" watt-hour meter test table; will test two- and three-wire single-phase meters of both the bottom terminal and socket types and two- and three-element polyphase meters, up to and including 50-amp., 120-240-volt capacity. **The States Co.**, Hartford, Conn.

the timed revolution control method on all other types of meters. An insulation breakdown test can be made while the meter is still in the test position. The registration indicator on the table makes it possible to make a direct reading of accuracy on the indicator dial for all "as found" tests. Switches are of the dead-front type.

•

Fluorescent Lamps

Bakelite desk and bed "Fluralamps"; use T8 15-watt, 18-in. fluorescent bulb; 110-120 volts, 60 cycles only. **Eagle Electric Mfg. Co.**, Brooklyn, N. Y.

Two new models of fluorescent lamps are announced by this company. Both are all-Bakelite construction; one is a desk type, the other is arranged for clamping to the head of a bed.

•

Transformer

"Spirakore" distribution transformers; in single-phase ratings through 500 kva. **General Electric Co.**, Schenectady, N. Y.

Introduced in 1937 in ratings to 5 kva., this company's "Spirakore" distribution transformer is now available in single-

WHEN YOU BUY **HUBBARD 4-11-44 WIREHOLDERS**
THEY HAVE BEEN EXPOSED TO A MOST CAREFUL SCRUTINY FOR MANY YEARS—AND FIELD TESTED "BY THE CARLOAD."

HUBBARD AND COMPANY
PITTSBURGH OAKLAND CALIFORNIA CHICAGO

HANG THE LOAD ON HUBBARD HARDWARE"

A New Year's Suggestion For Utility Executives:

1 **CHECK** the number of homes you have been serving at a loss. (Your "break even figure" is about $1.50 to $1.75 per month—Right?)

2 **RESOLVE** for 1941 to put a sizable group of these "Judy O'Grady income" customers on the profit side of your dividing line. To do this—

3 **HAVE** an Electromaster representative go over with you their tested-and-proved Range Marketing Program. You'll see exactly how your utility can use it where bigger domestic loads are needed most. (The coupon below is for your convenience.)

(For Utility Executives Only, Please)

ELECTROMASTER, INC., 1803 Atwater St., Detroit, Michigan

Yes, we'd like to look over this plan—particularly your proofs that it works. This request puts us under no obligation.

Utility.....

By.....

Title.....

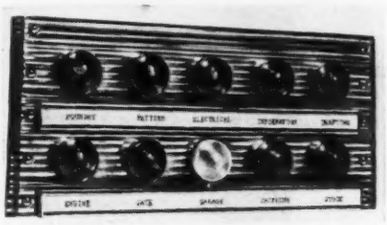
Address.....

phase ratings through 500 kva. Smaller models feature a core assembled around the coils in two continuous circular windings. In larger ratings the core is sectionalized and is elliptical in shape. Ends of cold-rolled silicon steel sections, after annealing, are butted together with joints so located that the effect on magnetic characteristics of the transformer is negligible, according to the manufacturer.

•

Signal Strips

To facilitate the use in multiple of signal lights, toggle switches and push buttons, this company has developed a line of standardized mounting strips for appli-



Typical annunciator made with "Kirkland" stainless steel mounting strip; devices used are for service on voltages to 200; **H. R. Kirkland Co.**, Morristown, N. J.

cation in the signal, control and general annunciator fields. Strip is furnished with all devices mounted on it, ready to install and put in service. It's available in three lengths, to contain two, three or five units per strip.

•

Commercial Fluorescent

"The General:" ceiling and suspension types. **The F. W. Wakefield Brass Co.**, Vermilion, Ohio.

Designed to accommodate the new 60-in., 100-watt fluorescent tube, the reflectors of these new fixtures have been designed to direct a majority of the light downward; however, the top of the reflector is open to allow illumination of the ceiling area. Translucent plastic material is used for the sides of the reflector; interior is finished in white enamel. Louvers provide for shielding of the light source. Ceiling type fixture fits acoustical ceilings. Lamps may be unlocked and removed through opening in top of luminaire.

•

Door Operator

Motor on this electric operator for residential garage doors is now rubber-cushioned and has a rubber coupling between it and the associated speed reducer, as an aid to quieter operation. Other features of this operator are worm and worm gear speed reducer (running in oil), friction clutch and limit-relay, combining limit

Motor on Model "S" electric operator for overhead-type doors; 1/4-hp., 60-cycle, 110-volt, single-phase. **Barber-Colman Co.**, Rockford, Ill.

switch and relay, which prevents motor from running at the end of the stroke because of sticking relay contacts.

•

Multiple Tap

With this new vise-type tap for making six taps at one junction, any one tap can be removed without disturbing the others.

Multiple tap. **Fargo Mfg. Co.**, Poughkeepsie, N. Y.

On the run the copper-alloy tap has a range of from No. 4 solid to No. 1/0 solid and on the tap from No. 8 solid to No. 4 solid.

•

Brush Seater

Carbon brush concaver; takes various size brushes for 4- to 48-in. diameter commutator. **Ideal Commutator Dresser Co.**, Sycamore, Ill.

In forming brushes to the correct commutator curvature with this "French curve" device, the old brush is clamped on the movable angle plate and used as a template to locate the arc segment on the cutting guide slot, this arc corresponding to the contour of the commutator or slip ring. After this segment is found, the angle plate is fastened in place and all brushes formed without further set-up. Cutting head of this unit may be driven with an electric drill or electrical shaft drive.

•

"Soft-White" Fluorescent

Soft-white fluorescent lamps; in 15-, 20-, 30- and 40-watt sizes. **Westinghouse Lamp Div.**, Bloomfield, N. J.

By combining approximately two parts of daylight phosphor with one part pink phosophor, the soft-white fluorescent color is produced, making the latest addition to the seven available fluorescent colors. Richer in red light, the new lamp using this color is particularly applicable in restaurants, butcher shops, night clubs, hotels, meat showcases and food markets.

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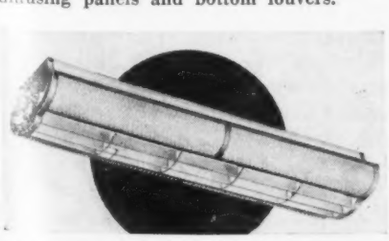
Fluorescent Fixture

For commercial or interior lighting, this lighting fixture, which houses 40-watt fluorescent lamps, makes use of plastic diffusing panels and bottom louvers.



"Miralume C-205" fixture; 200 watts; with four 40-watt lamps in daylight or white. **Hygrade Sylvania Corp.**, Miralume Div., Ipswich, Mass.

Noise Filter

"LF-2" multi-section plug-in filter; for use on 115-volt lines, a.c. or d.c. **Sprague Products Co.**, North Adams, Mass.

Multiple-section inductance and capacity filter is offered for use on very troublesome sources of radio interference. It is designed for installation at the convenience outlet to which the interfering electrical device—shaver, hair dryer or similar equipment drawing up to ½ amp.—is connected. Ground connection is provided.

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TECHNICAL LITERATURE

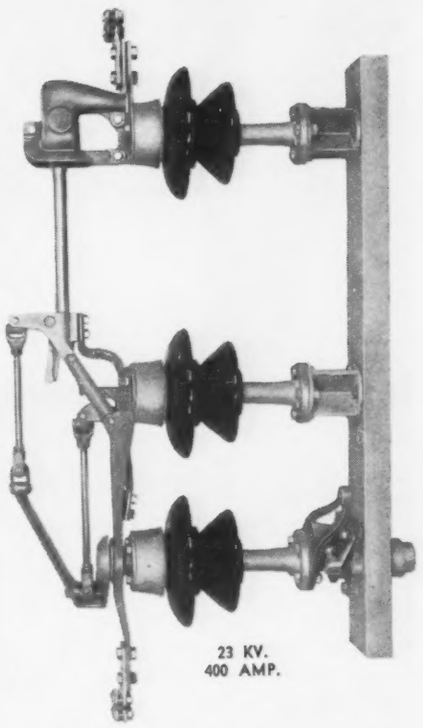
PHOTO RELAYS—Theory and application of the light-operated relay are covered in the 32-page booklet "Photo Relays, Their Theory and Application," by F. H. Shepard, Jr. In the five chapters making up the booklet, Mr. Shepard treats of photo-electric phenomena, amplifiers, glow discharge tubes, light sources and applications, including various circuit diagrams. Copies of the booklet may be secured from Allied Control Co., Inc., 227 Fulton St., New York, N. Y., at 25 cents each.

MATERIAL HANDLING—Material handling with industrial trucks is covered thoroughly in the new 68-page "Material-Handling Handbook", published by the Industrial Truck Statistical Association, 208 South La Salle St., Chicago, Ill. Management, organization and engineering of an industrial truck-handling system are treated in detail. The book is available from the association headquarters without charge.

FARM LIGHTING—"Electric Light for the Farmstead", discussed the importance of good lighting, essentials for good lighting, wiring for good lighting, light for the farmhouse, remodeling old installations and equipment, yard lighting, lighting the farm buildings and planning lighting for farm buildings. Copies of the 64-page bulletin may be secured from the Superintendent of Documents, Washington, D. C., at ten cents each.

A.S.T.M. SPECIFICATIONS — Twenty-four of the forty A.S.T.M. specifications covering pipe and piping materials, particularly materials used in high-temperature and high-pressure services are included in the "A.S.T.M. Specifications for Pipe and Piping Materials for High-Temperature and High-Pressure Services." Eleven of the 24 cover various types of carbon and alloy steel pipe and boiler tubes, etc. Copies of the 153-page publication are available from A.S.T.M. headquarters, 260 South Broad St., Philadelphia, Pa., at $1.25.

CANADIAN STANDARDS—"Pull-off Plugs for Electro-Thermal Appliances (2nd Ed.) (C 22.2 No. 16–1940)" and insulated Conductors for Power-operated Radio Devices (C 22.2 No. 57–1940)" are two standard specifications under Part II of the Canadian Electrical Code. Copies of these may be secured from the Canadian Engineering Standards Association, National Research Bldg., Ottawa, Canada, at 50 cents. The association has also issued "C.E.S.A. Standard Specification for Paper-insulated Lead-Covered Cable (C 68(A)–1940)," the first of a series of specifications covering insulated power cable, intended to apply to all sizes and classes of impregnated paper-insulated lead-covered cable for the transmission and distribution of electrical energy, as installed under average conditions. Copies are priced $1.



All these important points are embodied in Type JC's design:

1-Low Installation Costs
2-Easy, All-Weather Operation
3-Reduced Maintenance Costs

You can reduce your disconnecting switch maintenance costs and eliminate many troubles by specifying Southern States' Type JC, the vertical break switch with one rotating and two stationary insulator units.

Well-thought-out design means reduced installation time; this results in low installation costs.

Powerful ice-shattering and corrosion-breaking leverages withdraw the blade from between the contacts in all kinds of weather. Greaseless, rust-proof bronze ball bearings add to the easy, all-weather operation.

Blade action is positively controlled —no stops are required. Consequently, operation is smooth and free from shocks and stresses.

These points, plus other refinements, mean that the JC Switch has long, trouble-free life. Maintenance costs are on rock bottom.

A Southern States representative will be glad to discuss the Type JC Switch further with you or . . .

Write for Bulletin 325

Southern States

Equipment (SS) Corporation

28 S. 20th St. Birmingham, Ala.

NEWS ABOUT PEOPLE

Connecticut Light Makes Changes in Personnel

Robert L. Lagerquist, office manager of the Waterbury district of the Connecticut Light & Power Co., has been appointed supervisor of customer relations with headquarters at Waterbury. Mr. Lagerquist entered the company's employ in 1928 as an auditor. His recent post will be filled by Ernest H. Green, who has been Mr. Lagerquist's assistant. Guild B. Curtis has been named office manager for the company at Meriden, succeeding Paul L. Moran, who has been transferred to New Britain as office manager. Albert F. Sprafke becomes assistant office manager at Waterbury and Carl R. Larson succeeds the late Daniel L. Curtin as office manager at Winsted.

•

Will Direct Operations for Hygrade Sylvania

At a meeting of the board of directors of Hygrade Sylvania Corp. Walter E. Poor was elected executive vice-president in charge of all operations of the company. Mr. Poor will make his headquarters at the New York City offices of the corporation, located at 500 Fifth Avenue.

Mr. Poor, who has been with the company for several years, has specialized in engineering and is a graduate of the Massachusetts Institute of Technology.

•

▶ ADDISON F. VARS, has been elected president of the Sterling Engine Co., Buffalo, N. Y., and EDWARD H. TOWNSEND has been named as executive vice-president and treasurer. SPENCER H. LOGAN, president since 1939, was elected chairman of the board, succeeding CHARLES A. CRIQUI, who becomes vice-chairman. The membership of the board was increased from five to seven, the new members being Mr. Townsend and Frank G. Raichle, Buffalo attorney, who was subsequently elected secretary.

•

G. E. Cullinan Retires as Graybar Vice-President

George E. Cullinan, senior vice-president, retires from the Graybar Electric Co., Inc., effective December 31. At this time Mr. Cullinan will have completed 39 years and five months of active service.

Following graduation from Williams

Blank & Stoller

College in 1901, Mr. Cullinan joined the statistical department of the Western Electric Co. After filling several jobs in New York, he was transferred to the St. Louis branch, becoming assistant manager in 1908, manager the following year, and then western district manager. A transfer to Chicago followed, where he was successively manager of the distributing house there and central district manager. When the supply department became a distinct organization of the Western Electric Co., in 1923, Mr. Cullinan returned to New York as general sales manager. In 1926 he became vice-president in charge of sales of the Graybar Electric Co., which replaced the supply department of Western Electric, and in 1940 he was made senior vice-president.

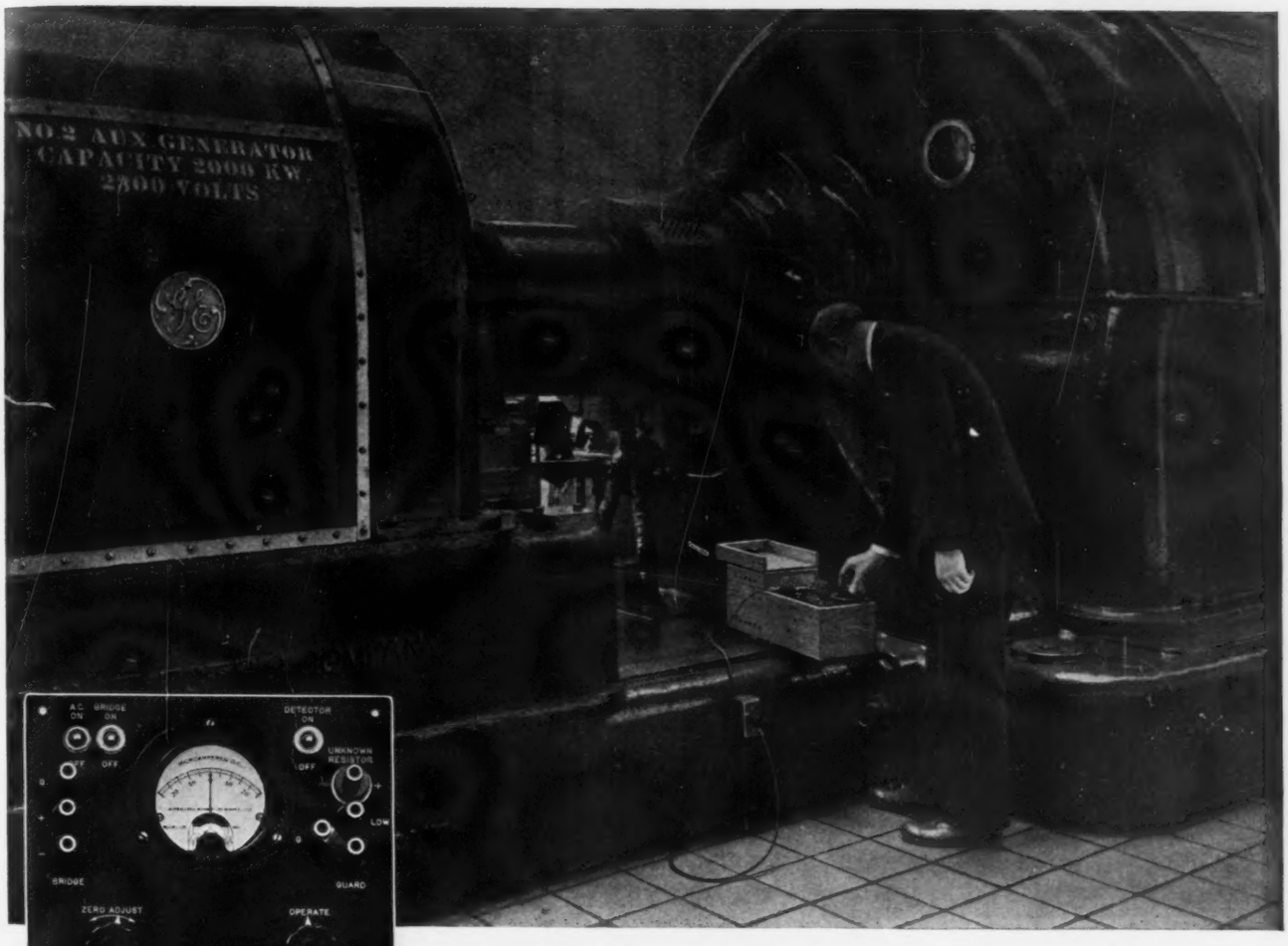
In addition to his activities for Graybar, Mr. Cullinan has been very active in association work. He has served as chairman of the National Electrical Wholesalers Association, has been active in several Chambers of Commerce and has served on the executive committee of the National Electric Light Association and the Society for Electrical Development. An outstanding event in Mr. Cullinan's career was the selection of Mr. Cullinan in 1930 for the McGraw Award. The citation for the award was "For persistent and unselfish labor for the education of the electrical industry in the economics of distribution."

•

▶ JOHN A. HERRMANN, formerly industrial engineer with the Indiana Service Corp., Fort Wayne, has joined the sales department of the Bulldog Electric Products Co., Detroit, Mich.

▶ ROBERT N. MIERS has been appointed eastern district engineer of Allis-Chalmers Manufacturing Co.'s steam turbine division, with headquarters in Boston, Mass. Mr. Miers has been traveling for the past six years out of Milwaukee on steam turbine sales and general engineering matters.

▶ J. K. HODNETTE was recently appointed manager of transformer engineering at the Sharon, Pa., works of the Westinghouse Electric & Manufacturing Co., succeeding H. V. Putman, who has become manager of the transformer division. Mr. Hodnette joined Westinghouse in 1923, first working in the test department and as an engineer in the materials and process department before beginning his work on distribution transformers in 1925. Early in 1940 Mr. Hodnette was honored by



PRICE:

Type 544-B Megohm Bridge . . . A. C. Operated with 500-volt supply

$235.00

Let us tell you more about this G-R instrument which can help you as it has helped others

WRITE FOR BULLETIN 664

Here's How You Can KNOW the Condition of Your Generator Insulation

IT IS NOW generally recognized by most central station engineers that a single measurement of the insulation resistance of electrical generators gives no true indication of generator leakage. The true value of generator insulation resistance can be obtained only by a series of measurements taken at increasing time intervals over a considerable period of time. From these resistance-time curves a true picture of the condition of the insulation may be obtained.

This bridge is equally suitable for measurements of insulation resistance on transformers and cables.

The General Radio Type 544-B Megohm Bridge with its 500-volt power supply is the best instrument available for obtaining resistance-time curves of any generator. Here is why it is preferred by a large number of leading central station engineers:

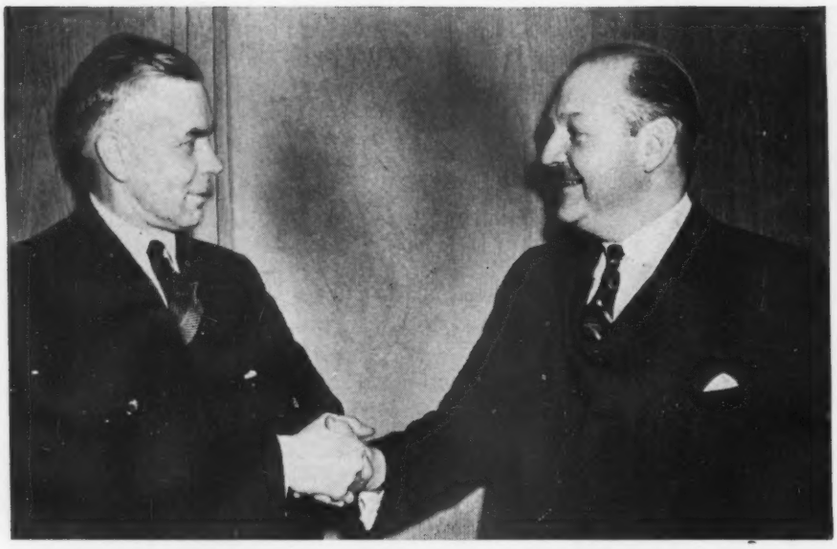
A-C OPERATION—portable (25½ pounds) no bulky batteries—no hand cranking of a generator

WELL REGULATED POWER SUPPLY—vacuum-tube stabilized (very essential when testing large generators with high-capacitance windings)

TEST VOLTAGE AT 500 VOLTS D.C.—the standard voltage for measurements of this type

VERY WIDE RANGE—up to 100,000 megohms—will measure the best of generator insulating materials

GENERAL RADIO COMPANY CAMBRIDGE MASSACHUSETTS



AIR UNIT MANAGERSHIP—Stuart M. Crocker (right) has relinquished his responsibilities as manager of the G.E. air conditioning and commercial refrigeration department, upon being elected a vice-president, and will henceforth be concerned with customer relations. H. L. Andrews (left) assumes direction of air conditioning and commercial refrigeration in addition to carrying on as head of General Electric's appliance and merchandise department

election as "a modern pioneer of the American frontier of industry" for his outstanding work in the development of the self-protected transformer. He has been granted ten patents dealing with major improvements in transformers.

▶ L. S. Cope, well known in Cleveland steel manufacturing circles, has been made development engineer for the Oliver Iron and Steel Corp., Pittsburgh, Pa. Mr. Cope brings to the Oliver Iron & Steel organization a broad experience in the manufacturing, engineering and metallurgical fields.

▶ Paul B. Currier, a traveling auditor for General Electric Co. since 1939, has been elected an assistant secretary and transfer agent of the company by the board of directors. In his new position Mr. Currier will be in charge of the stock transfer office at 570 Lexington Avenue, New York. He replaces Leland W. Mosher, who has been transferred to the staff of Comptroller I. D. LeFevre in Schenectady.

▶ J. P. Fraser has been appointed superintendent of hydro-electric plants by the British Columbia Electric Railway Co. Following graduation in electrical engineering from the University of Manitoba, he entered military service in the World War, and upon his return to Canada he joined the Canadian Westinghouse Co. at Hamilton, Ont. He was appointed engineer in charge of construction of electrical features in the Seven Sisters plant of the Winnipeg Electric Co., and then went to the Manitoba Power Commission as general superintendent and chief engineer, resigning that position to join the B. C. Electric organization.

OBITUARY

▶ G. Donald McIntyre, a member of the Michigan Public Service Commission, died in Jackson, Mich., recently, following a short illness. Mr. McIntyre had been a member of the commission since February, 1939, when he was appointed by the late Gov. Frank D. Fitzgerald at the time the old Public Utilities Commission was abolished and the Public Service Commission established.

▶ Edward J. Owens, for the past 15 years purchasing agent and office engineer for the New Brunswick Electric Power Commission, St. John, N. B., died suddenly while en route from his home to the commission offices. He was 46 years of age. A graduate of the University of New Brunswick, Mr. Owens joined the power commission when it was formed.

▶ Norman G. Kenan, long identified with the electric and gas industry in Cincinnati before his retirement as president of the Union Gas & Electric Co. nearly three decades ago, died on December 3 at his home in Cincinnati. He would have been 91 years old December 28. Mr. Kenan became associated with the Cincinnati Gas & Coke Co. in 1868. Advancing through the ranks, he became superintendent and engineer of all the company's works in 1887. The first electric light station built by the gas company was erected under his supervision in 1890, when he was assistant to the president. In 1892 he was elected vice-president. He was made president of the Cincinnati Gas & Electric Co. in 1893, succeeding Gen. Andrew Hickenlooper. After the leasing of the property to the Union Gas & Electric Co., in 1906, he resigned the presidency, but a few weeks later was elected president of the new corporation. In 1911 he took a year's leave of absence, making an eight-month tour of Europe. He retired a few years later.

▶ James T. Ball, 71, for 36 years an engineer with the Boston Wire Department, died at the Clinton (Mass.) Hospital on December 5. He was a native of Stanstead, P. Q., and was graduated from the Massachusetts Institute of Technology in 1886. He retired from the city's service some years ago and for a time was on the staff of the then Charles H. Tenney & Co. utilities at Boston.

▶ Hollis French, for many years a prominent consulting engineer at Boston, Mass., died at his home in that city November 21. He was born in Boston 72 years ago and was graduated from the Massachusetts Institute of Technology in 1889. For some time he was a partner in the firm of Hollis French & Allen Hubbard and his practice embraced much important power plant design and construction, besides institutional buildings, including recently erected structures for Yale University.

▶ Edwin A. Bowman, senior partner of Bowman & Bowman, electrical engineers, Greenwood, Miss., died in that city on October 14, in his thirty-fifth year. Mr. Bowman, who was born in Natchez, was graduated from the University of Louisiana in 1925. After serving an apprenticeship with the Dixie Construction Co., he became associated with the Alabama Power Co. as engineer in the distribution design engineering department. The firm of Bowman & Bowman has engaged in design and construction work for the Rural Electrification Administration.

▶ Dr. Karl G. Frank, inventor, and representative of the Siemens & Halske, A. G., and Siemens Schuckertwerke from 1903 until 1935, died at his home in North Caldwell, N. J., on December 13, after an illness of nine months. Dr. Frank was 68 years of age. He was born in Hanover, Germany, and received his education at the University of Munich, where he studied under Roentgen, the inventor of the X-ray. He came to the United States in 1903. Dr. Frank was the holder of many patents for inventions and had written many pamphlets on technical aspects of electricity and optics.

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CLIPS, PATTERSON
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HANDLES, HAMMER
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HOISTS, HAND and POWER
IRON, STAYBOLT
LUGS, BOILER, TANK and SILO
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PLATE STEEL, STANDARD QUALITIES
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SHAFTING
SHEETS
  ABRASION RESISTING
  ELECTRICAL
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  COLD ROLLED
  STAINLESS STEEL
  GALVANIZED and GALVANNEALED
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UNITED STATES STEEL

MANUFACTURING - MARKETS

Seek Near Stability in Price of Copper

Steps to insure a near stability in the price of copper at or near the present level have been all but formalized into definite policy by the defense planners in Washington. Chief implement of the program will be foreign imports to supply the difference between domestic production and the expanding market.

Copper requirements for 1941—all needs of normal commercial outlets, including the heavy electrical industry market, as well as the pyramided defense load—are now estimated at around 1,200,000 tons. Profitable domestic production, with the price at or near the present 12-cent peg, is estimated to supply 90 per cent of this.

Rather than permit a skyrocketing of prices to the 15-17-cent bracket to stimulate additional mine operations here, and rather than promote expansion of existing mines with their inevitable post-emergency deflative effect, the defense specialists plan to bring in foreign copper, or see that it is brought in to fill the gap.

Consideration is being given to one of two methods which can be utilized to get foreign metal into this country. The government itself can buy in the foreign market and invite contractors to bid on specific jobs for producing defense items made from copper supplied for the order, or the major companies, with both foreign and domestic holdings, can bring in foreign supplies to meet the needs. If this latter policy should require a reduction in the present 4-cent import excise tax, this will be done.

As this program for maintaining an adequate flow of the metal at a "reasonable price" becomes apparent it is considered inevitable that the policy will develop a flareup in the mining industry. Offsetting this, however, will be the fact that most of the foreign imports will come from South America, mainly Chile, and thus will play an important role in this nation's good neighbor policy and hemispheric defense.

•

New Bonneville Contract

A 20-year contract has been signed for delivery of 2,000 kw. of Bonneville-Grand Coulee power to the Pennsylvania Salt Manufacturing Co. for use in a sodium chlorate plant to be established in Portland, Ore. This brings to 218,352 kw. power commitments of the administration, of which more than 160,000 kw. has been to Aluminum Co. of America.

Award Breaker Order to General Electric

General Electric Co. has received a $301,080 contract for six 50-ton oil circuit breakers for Grand Coulee Dam, the Interior Department has announced. Officials said the circuit breakers would be shipped from the company's Philadelphia plant and that 836,000 lb. of oil, to accompany the breakers, would be shipped from Richmond, Calif.

The Grand Coulee Power Administration announced that General Electric had been awarded a $204,255 contract to supply circuit breakers for the Covington, Wash., substation.

•

Give Pay and Hold Jobs for Men in Service

Westinghouse Electric & Manufacturing Co., General Electric Co. and Western Electric Co. have made provisions for salaries and for continuance of various benefits to employees who are called for military service.

Employees who have been with Westinghouse for one year or more will receive a month's pay. At the end of their military service employees will be restored to their former positions. "Em-

SALES MEETING—Members of both inside and outside sales organization of Ohio Brass Co. at Mansfield during the recent sales meeting. Representatives in both the United States and Canada were present during the ten days of sessions

"GULFCREST OIL

is the MOST STABLE TURBINE OIL we've ever used"...

says Power Plant Engineer

GULF PERIODIC CONSULTATION SERVICE plays on important part in the operation of this large modern Power Plant.

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2. *Highest resistance to oxidation.* This famous ALCHLOR Process synthesizes and rearranges the molecular structure of certain hydrocarbons, resulting in a finished product of greater stability. GULFCREST OIL stands alone in its high resistance to oxidation.

3. *Highest resistance to acidity and sludge.* Because of the elimination of oxidation catalysts in addition to the unparalleled refining power of the Alchlor Process, these oils form less gum deposits, less emulsion and sludge, when mixed with water over a period of several years continuous operation, than any other turbine oil of which we have record.

4. *Highest kilowatt-hour performance.* Because Alchlor not only makes possible an oil more thoroughly refined and homogeneous but also creates anti-oxidants, these oils have great resistance to deteriorating influences and are longer lived. Less make-up oil is required.

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ployment or promotion to fill a vacancy created as a result of granting the leaves," said W. G. Marshall, vice-president, "will be considered temporary."

General Electric Co. has made similar provision for its employees with one year or more of continuous service and provision has been made for continuance of various benefits such as additional group life insurance, additional pension, etc.

Western Electric Co. employees of a year or more standing will be paid their regular salaries, less government pay, for the first three months of their military service. Provision has also been made for reinstatement and for continuance of benefits.

Copperweld Steel Co. has advised its employees that the positions of those who may be drafted will be maintained for them during the year of their absence, that they will be paid in cash for the vacation period to which they are entitled and that the company will maintain and pay their group insurance policies.

•

New District Managers Assigned by Frigidaire

Five changes in district executive personnel have been announced by Frigidaire Division, General Motors Sales Corp., together with the announcement of establishment of a new district headquarters in Milwaukee, Wis.

Frigidaire has drawn on its overseas export division for two of its new district managers. H. L. McGurk, formerly associated with this division, has been named manager of the company's Fort Worth office to replace W. G. Jennings, who requested a leave of absence for military service. Edgar Carmel, until recently branch manager in Paris, succeeds R. C. Golt as district manager at New Orleans. From New Orleans Mr. Golt has been transferred to Kansas City, Mo., where he has succeeded P. K. Abry. Mr. Abry is now located in the company's Dayton, Ohio, headquarters, where he is associated with the sales department.

In a realignment of territory north of the Wisconsin-Illinois state line Frigidaire has established a new district office in Milwaukee. Ben Markus, who has held a sales managership for outlying territory covered by the company's Chicago office, has been appointed as manager of the new office.

New York Metal Prices

	Dec. 23, '40 Cents per Pound	Dec. 18, '40 Cents per Pound
Copper, electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.50	5.50
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spot	7.64	7.64
Tin, Straits	50.10	50.05
Aluminum, 99 Per Cent	17.00	17.00

* Delivery Connecticut Valley.

Field Reports on Business

Plant operators are making new surveys as to the extent to which they can step up production to speed national defense requirements. Inquiries are in good number concerning electrical equipment. Utilities are to speed their new construction program to keep well ahead of power requirements. Several new plants are under consideration. Estimates are that appliance sales next year will break all records. Problem may be difficulty in meeting the demand. Reports indicate that electrical manufacturers have backlogs which will carry production schedules for many months. Priority orders are likely to become more pronounced.

NEW YORK

The new thinking in the Administration concerning national defense production is expected to bring about a sharp speed-up in schedules. Priorities will soon be the rule, rather than the exception.

Year-end inventory taking is likely to result in large orders for certain types of products. Electrical equipment manufacturers are due for a rush of new business from the utilities as pressure continues for more power. Utility budgets have been revised upward, with a great deal of attention being paid to the possibilities of providing for larger power demands from manufacturers. One of the big problems facing the utilities is the method which the SEC will require for new financing. There will be some difficulties to be overcome in refinancing to cut interest charges.

Last week Westinghouse announced sharp reductions on the medium- and higher-priced refrigerators and ranges. The new washer, "Laundromat", is to be priced under $200. A plug-in air-conditioning unit, which heats or cools, was shown. Kelvinator has announced reductions of as much as $30 in its 1941 refrigerators.

Engineering News-Record reports engineering construction awards for last week the fifth highest of the year and 175 per cent over the same week last year. All types of awards were higher and large-scale private housing reached the highest point since August 24, 1939.

General Electric is spending approximately $400,000 for expansion of the eastern facilities of the plastics department. The expansion will take place in Pittsfield, Mass., and at Meriden, Conn., with additional equipment at the Lynn, Mass., plant.

General Electric announced price reductions as much as 20 per cent on electric ranges and washers and the introduction of a new completely automatic washer. Advance models of the washer are to be placed in homes for final field tests before placing them on the market late next spring or in the summer.

PACIFIC COAST

Major appliance sales in a large typical Pacific Coast area show that, comparing number of pieces sold, ranges and water heaters have been practically even during this year as compared with last, washers and ironers increased 15 per cent, cleaners 5 per cent, sewing machines 25 per cent, refrigerators 50 per cent and radios 30 per cent, this last increase being entirely in table and portable models.

Miscellaneous industrial orders cover $5,000 mechanical drive turbine for an oil company; $9,000 motor reducers for gold dredgers; $6,000 of motors, sizes 7½ to 20 hp., for a salt works; $40,000 fractional-horsepower motors for business office machines; $6,000 of food machinery; $5,000 of 1-hp. speed reducers for a lumber mill, and $15,000 of 25- and 200-hp. motors for an iron works.

Pacific Gas & Electric Co. is making a $35,000 rural extension in the Redding area and 6,750 kva. of shunt capacitors, costing $63,000, near Marysville, both in northern California. Lighting business headliner items are flying field floods, camp street lighting and office fluorescent installations. Fluorescent business has been hampered by factory fixture deliveries due to sales volume. Typical lighting orders cover floodlighting of Olympia Capitol in Washington, 120 standards for Alameda, 750 standards for Honolulu and a $56,120 award for lighting McChord Field near Tacoma.

CHICAGO

Additional defense contracts placed last week in this area played a prominent part in further extending business activity. The demand for electrical equipment continues to rise as industrial plants are continually being forced to expand facilities to meet increased production requirements. In addition to the high level of industrial activity, reports from retailers indicate the holiday turnover is already the highest in many years and still rising. Electric power output rose 1,500,000 kw.-hr. above the previous week to 8 per cent over a year ago.

A 50-ton electric furnace has been ordered for the Sterling, Ill., plant of the Northwestern Steel & Wire Co. Defense contracts for electrical equipment placed here last week included transformers, $78,-266; lamps, $40,660; microphones, $48,-973; cranes, $183,900; automatic tools, $167,485. Bids were requested on 63,000 ft. 3-in. asbestos conduit and 9,500 ft. 2-in. fibre conduit.

NEW ENGLAND

The strong demand for electrical products continues with unabated vigor due to expansion of power plants and industrial modernization. Shipyards are purchasing motors and control apparatus and have added to their shop facilities. Boston Yard bought eight 150- to 200-amp. welders. Reading, Mass., municipal light plans underground extensions and street-lighting modernization.

About 5,000 kva. in distribution capacitors have been placed by Cambridge Electric Light. An electric furnace manufacturer is operating at full capacity with a backlog extending through June, 1941. Active cable and wire business includes $228,388 in orders to Collyer Insulated Wire Co., Pawtucket. Commercial electric apparatus cooking inquiries are active and the 1941 hotel outlook is very promising.

Recently the government ordered 166 kw. in electric fryers; two Boston restaurants installed 150 kw. in electric cooking appliances. Housing in localities engaged in defense contracts reveal a strong prospect for electrical supplies.

The 15th edition of this book is a veritable encyclopedia on Central Station practice—invaluable as a sales aid and engineering reference for manufacturers and distributors selling to this field, for consulting and power-sales engineers, public service commissions, financial houses. For the central stations themselves, it is an up-to-the-minute roster of the men in other plants whom they are anxious to keep in touch with for personal or business reasons.

This Latest Edition is a complete directory, classifying geographically all operating and holding companies in North America and U.S. possessions; also all plants, both privately and municipally owned. It contains an alphabetical index to all companies listed—over 4,000 of them. Listings include names and titles of all responsible officials; full data on power generation, transmission, distribution, number of meters, etc.

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...the name of the operating company or companies serving a given community

...the communities served by a given company

...the number of meters connected

...the number of rural customers

...ratings and types of units in generating plants

...type of distribution system and principal distribution voltage

...inter-company energy purchases

...names of the administrative, managing and operating officials listed by title for each of the companies

...information on holding companies, with cross-reference explaining the relationship with the operating company

In short, here's your most comprehensive, up-to-the-minute guide to the more than 4000 electric systems, private and municipal, in the United States, Canada and United States possessions.

Plant Equipment and Operating Data—The Central Station Directory lists for every plant its total generating capacity; the types and capacities of all prime movers and generating units; the voltages, phases, cycles and wiring of the distribution system; total number of meters connected, etc.

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Sales Opportunities

SPENCER, N. C.—Duke Power Co., Charlotte, N. C., has authorized further expansion in Buck steam-electric power plant at Spencer, and will begin work on erection of addition at early date. New unit will be equipped for increase of 40,000-kw. capacity, with installation to include turbine-generators, high-pressure boilers and auxiliary equipment. It is scheduled for completion in about 18 months and is estimated to cost close to $3,000,000. Company now has work in progress on extensions at this same station to advance capacity by 80,000 kw., and it is expected to have new units ready for operation next July. The additional development at plant will form part of construction budget of approximately $5,000,000, now being arranged by company for 1941, the majority of the remainder of such fund to be used for extensions in transmission and distributing lines, power substations, and miscellaneous structures.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until January 6 for one portable, high-potential test set, and one portable, dielectric, testing equipment for Grand Coulee hydro-electric power plant, Grand Coulee, Columbia Basin project, Wash. Equipment will be installed by government (Specifications 1460-D). Also, until January 30, for main and auxiliary control equipment for units Nos. L-1, L-2 and L-3, control equipment for station-service units, load and frequency control equipment, and heating distribution equipment for same station. All equipment will be installed by Government (Specifications 946).

CINCINNATI, OHIO—Aluminum Industries, Inc., 2438 Beekman Street, manufacturer of aluminum and aluminum-alloy products for automotive and other service, plans installation of motors and controls, duct lines, industrial lighting equipment, transformers and accessories, switchgear, conveyors and other equipment in new plant on 25-acre tract of land at Bridgetown and Werk Roads, comprising five main one-story and several auxiliary buildings, totaling about 500,000 sq. ft. of floor space. Work will be placed under way soon. Cost reported over $1,500,000.

DECORAH, IOWA—Interstate Power Co., Dubuque, Iowa, has approved plans for remodeling and improving hydro-electric power plant at Decorah, and will proceed with work at once. No cost announced.

WYANDOTTE, MICH.—Municipal Service Commission has authorized plans for expansion and improvements in municipal power plant, including installation of new turbine-generator unit and auxiliary equipment. Extensions also will be made in switchyard facilities and distribution lines. Cost estimated close to $560,000. Burns & McDonnell Engineering Company, 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

NEW YORK, N. Y.—RCA Manufacturing Co., Inc., 411 Fifth Avenue, New York, manufacturer of radio transmitting and receiving apparatus, phonograph equipment, etc., plans installation of motors and controls, regulators, duct lines, industrial lighting facilities, switchgear, conveyors and other equipment in conneection with expansion in plants at Camden, N. J., and Indianapolis, Ind., including new buildings, for increased capacity for radio apparatus for Government. Company has arranged contract with Navy Department, Washington, D. C., to provide fund of about $2,370,000 for entire project.

HUNTINGTON, W. VA.—United States Engineer Office, Huntington, plans call for bids early next year for two large electric-operated pumping stations on sites on Four-Pole Creek and Krouts Creek, respectively, for flood control project now in progress. A dam will be built at each place. Transmission lines will be built to pumping stations for power service. Both plants and facilities are estimated to cost close to $1,000,000.

BAYTOWN, TEX.—Humble Oil & Refining Co., Humble Building, Houston, Tex., plans new electric power station at oil refining plant at Baytown. Proposed to begin work soon. Cost estimated close to $160,000, including equipment.

KNOXVILLE, TENN.—Director of Purchases, Tennessee Valley Authority, Knoxville, receives bids until January 6 for auxiliary power switchboards for hydro-electric power plant at Watts Bar dam. Also, until January 7, for four traveling gate hoists, two for installation at Watts Bar dam station and two for Cherokee dam; each hoist to include a steel carriage or platform, propelled by electric motor and carrying hoisting equipment. **Four hoists to weigh 330,000 pounds.**

MUSCODA, WIS.—Village Council plans expansion in municipal power plant, including installation of new diesel engine-driven electric generator and auxiliary equipment for increased capacity. Work will be carried out at early date.

..FORT DODGE, IOWA—Fort Dodge Gas & Electric Co., is considering extensions and improvements in electric power station, including installation of additional equipment. Cost reported close to $500,000, with equipment. Work to start in 1941.

WASHINGTON, D. C.—General Purchasing Officer, Panama Canal, Washington, receives bids until January 6 for watthour meters, oil circuit breakers, bulb-type rectifiers, junction-type boxes, snap switches, toggle switches, quantity of two-conductor cable, copper magnet wire, etc. (Schedule 4660); until January 7, for quantity of bulkhead-type electric lighting fixtures, 100-watt, for marine use, complete; ceiling-type electric lighting fixtures, chain pendant-type lighting fixtures, wall bracket lighting fixtures, shallow bowl-type reflectors, deep bowl-type reflectors. (Sch. 4662).

KEARNY, N. J.—Federal Shipbuilding & Dry Dock Co., Lincoln Highway, plans installation of motors and controls, transformers and accessories, duct lines, switchgear, conveyors, electric hoists and other equipment in connection with expansion in shipbuilding plant for construction of destroyers and other vessels for Government, including new shops and other buildings, shipways and other facilities. Contract has been made with Navy Department, Washington, D. C., for fund of $2,250,000 for project. Work will proceed at once.

•

Slattery Writes on REA

How electricity in rural areas is making an important contribution to the national defense program is dramatically told in a book "Rural America Lights Up" by Harry Slattery, administrator of the Rural Electrification Administration. It is published by National Home Library Foundation, Washington, D. C. Price 25 cents.

Co-op Seeks Permit for Hydro Project

Announcement has been made that the Moon Lake Electric Association, Inc., a co-operative having its principal place of business at Mt. Emmons, Utah, has applied to the Federal Power Commission for a license to authorize the construction, operation and maintenance of a hydro-electric project on the East Fork of the Lake Fork River in the region of Altonah, Duchesne County, Utah.

The project, now under construction, is estimated by the applicant to cost $189,641 and will include a power house to accommodate three 300-kw. units and other appurtenant works. Two units are proposed to be installed at this time and a third unit later. Substations, switchyards and transmission lines will not be covered by this license, according to the applicant.

Proposed market for electric energy to be developed is on the now existing lines in Duchesne and Uintah counties, Utah, for distribution to rural consumers. Financing of the project is to be through a loan from the Rural Electrification Administration and completion of the entire work is scheduled for September 1, 1941.

•

Hawaiian Utility Files New Preferred with SEC

Hawaiian Electric Co., Ltd., has filed with the Securities & Exchange Commission a registration statement covering 100,000 shares of series B 5 per cent cumulative preferred stock, $20 par value, and transferable full share subscription warrants to purchase 50,000 of the preferred shares.

Company is offering 50,000 shares of the new 5 per cent stock in exchange, on a share-for-share basis, for its outstanding series A 6 per cent preferred, which has been called for redemption on January 15, 1941. The company will offer common-stock holders at the close of business on January 15 50,000 shares of preferred and shares not issued in exchange, for subscription, pro rata, at $20 a share.

•

Town to Extend Lines

Town commissioners of Centreville, Md., have been granted authority by the Maryland Public Service Commission to exercise a franchise granted by the commissioners of Queen Anne's County and to begin expansion of their electric system by constructing electric transmission and distribution lines in the county.

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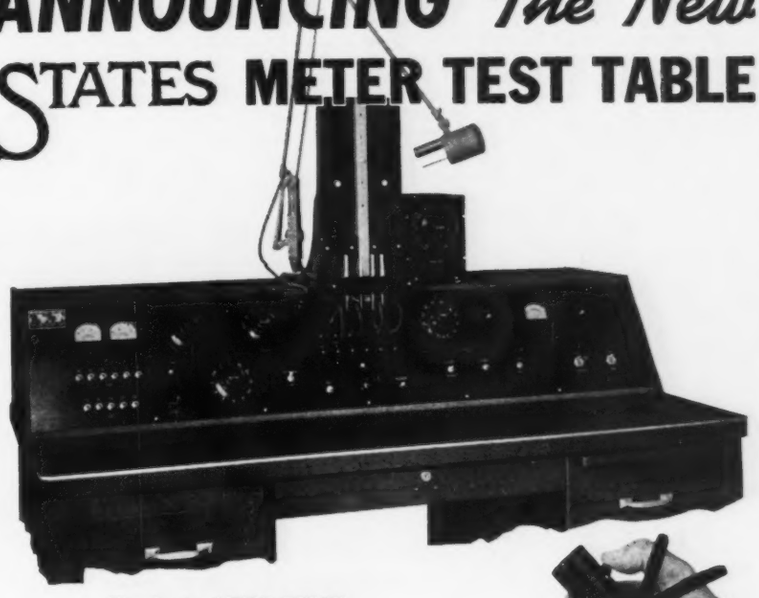

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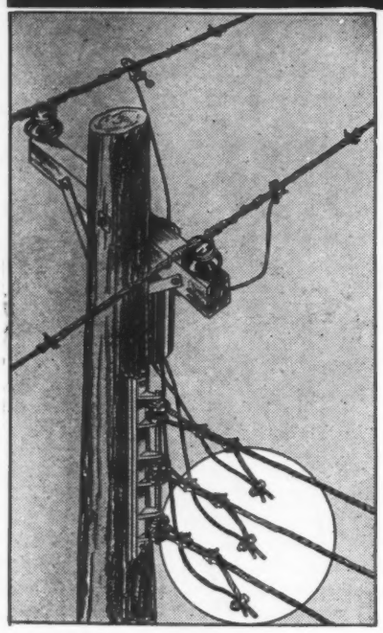

Rural line transformer pole with a secondary span to a yard pole.

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Recent Rate Changes

WISCONSIN PUBLIC SERVICE CORP. has made a rate reduction of $50,000 a year, which will affect 1,150 electric power users, according to an announcement made by the state Public Service Commission. The cut will apply to service rendered following December meter readings. Rate reductions of the utility during 1940 now total approximately $178,000. In addition to the $50,000 decrease announced recently, there were residential rate reductions of $40,000 in January, $40,000 in July, and a commercial rate cut of $43,500 in March and a $4,000 cut in October to commercial heating and cooking customers.

APPALACHIAN ELECTRIC POWER CO. has been ordered by the West Virginia Public Service Commission to make further reductions in its rates for southwestern West Virginia customers, effective January 1. The commission estimated that the order will mean an annual saving of not less than $400,000 for various types of power users. The company offered the revised rates at the suggestion of the Public Service Commission.

EDISON SAULT ELECTRIC CO., has been ordered by the Michigan Public Service Commission to reduce its rates $21,000 a year at Sault Ste. Marie and has ordered a reserve set aside which will be paid in dividends to customers if the company renews its contract for power from the federal government at a favorable rate in 1942. The city of Sault Ste. Marie and the company jointly petitioned for an investigation of the rates. Commissioner Gilbert T. Shilson said the company obtained its power from the federal hydro-electric plant at the Sault locks on a 30-year lease which expires in June, 1942. He said there was doubt as to whether the contract would be renewed, or at what price if it were renewed. Therefore, Commissioner Shilson said, the commission ordered a special reserve of $25,401 set aside under commission jurisdiction until 1942. If the contract is renewed at a favorable rate the money will be distributed as a dividend to customers, but if the contract is higher, he said, the reserve will be used to meet the increase. The new rate for residential customers is 5 cents per kilowatt-hour for the first 15 kw.-hr., 3½ cents per kilowatt-hour for the next 35 kw.-hr., 2½ cents per kilowatt-hour for the next 50 kw.-hr. and 1½ cents per kilowatt-hour for all in excess of the total. The new commercial rate is 5½ cents per kilowatt-hour for the first 30 kw.-hr., 4 cents per kilowatt-hour for the next 60 kw.-hr. and 2 cents per kilowatt-hour for over 90.

ELIZABETH CITY, N. C., consumers of electricity will benefit approximately $20,000 annually by new schedules of rates announced by Superintendent J. C. Parker of the city Public Utility Commission. The new schedules will go into effect with the readings from December 10 to January 10. Accompanying the change is the complete abolition of commercial lighting rates. Everything will be changed into a general service rate. Users now having two meters, one for lighting and one for power, will effect a greater saving by combining the two meters into a one meter hook-up, it was said.

NEW YORK PUBLIC SERVICE COMMISSION has granted the village of Springville, which operates a municipal electric plant, permission to put into effect reduced rates which will result in savings of approximately $3,000 per annum to customers in Springville and adjacent territory in the town of Concord, Erie County. The new rates will become effective January 1.

RATE CHANGES effected during the month of November resulted in an estimated reduction of $1,037,094 for utilities in the state of Illinois. Total electric reductions amounted to $258,287. Reductions by the Illinois Bell Telephone Co. account for the large total.

•

New REA Allotments; Contracts Approved

Announcement has recently been made by the Rural Electrification Administration of new allotments, as follows:

ALABAMA—Cullman Electric Co-operative, Cullman, L. Petree, supt., $47,000 to complete the system.

COLORADO—Empire Electric Association, Inc., Dove Creek, George Herron, supt., $17,000 for the installation of a mobile diesel generator.

KENTUCKY—Cumberland Valley Rural Electric Co-operative Corp., Pineville, James C. Bright, president, $295,000 to build 267 miles of lines, 1,349 members in Harlan, Leslie, Letcher, Bell, Whitley and Knox counties.

MICHIGAN—Western Michigan Elecrtic Co-operative, Scottsville, Frank C. Comstock, supt., $240,000 for construction of a generating plant.

MINNESOTA—Minnesota Valley Electric Co-operative, Jordan, H. A. Schimelpfenig, acting manager, $96,000 to build 124 miles of line, 281 members in LeSueur, Rice, Scott, Carver and Sibley counties.

OREGON—Lane County Electric Co-op., Inc., Room 3 Old P.O. Bldg., Eugene, Ronald W. Buford, acting superintendent, $595,000 to build and acquire 352 miles of line, 1,311 members in Lane County. North Douglas Electric Co-op., Inc., Medical Arts Bldg., Roseburg, Robert L. Adams, manager, $125,000 for construction of 43 miles of transmission line.

PENNSYLVANIA—Adams Electric Co-operative, Inc., Gettysburg, Calvin A. Cluck, supt., $150,000 to build 180 miles of line, 540 members in Frederick and Carroll counties, Md.

TENNESSEE—Caney Fork Electric Co-operative, McMinnville, Oscar B. Wemack, president, $445,000 to build 462 miles of line, 2,251 members in Warren, White, DeKalb, VanBuren, Cannon and Coffee counties.

VERMONT—Washington Electric Co-operative, Inc., East Montpelier, Captain Clarke Millen, supt., $20,000 for additional generating equipment.

WYOMING—Lower Valley Power & Light, Inc., Freedom, Max Snell, supt., $18,000 to build 23 miles of line, 52 members in Lincoln County, Wyo., and Bonneville County, Idaho.

Recent construction contracts approved by the Rural Electrification Administration include the following:

ARKANSAS—Southwest Arkansas Electric Co-operative Corp., Texarkana, Calvin M. Hervey, Jr., supt., and Ray W. Chanaberry, Realty Bldg., Louisville, Ky., engineer, contract to Killoren Electric Co., Appleton, Wis., 194 miles of line, 382 members; bid, $143,484.

INDIANA—Wayne County REMC, Richmond, Lester Snyder, supt., and Bevington-

Williams, Inc., Indianapolis, engineer, contract to Cater Construction Co., Blue Springs, Mo., 183 miles of line, 476 members; bid, $122,646.

Iowa—Allamakee-Clayton Electric Co-op., Inc., Postville, Kermit M. James, supt., and K. R. Brown, engineer, contract to Hoak Construction Co., 621-63d St., West Des Moines, 330 miles of line, 591 members; bid, $211,919.

Louisiana—Claiborne Electric Co-op., Inc., Homer, T. E. Stevenson, supt., and Ray W. Chanaberry, Inc., Louisville, Ky., engineer, contract to W. A. Smith, Louisville, 203 miles of line, 388 members; bid, $134,000.

Alabama—City of Athens, Gordon Persons & Co., Inc., Montgomery, Ala., engineer, contract to Montgomery Electric Co., Montgomery, Ala., 100 miles of line, 457 members; bid, $64,896.

Delaware — Delaware Rural Electric Assn., Greenwood, A. G. Ingram, supt., and Gibbs & Hill, Inc., Pennsylvania Station, New York, N. Y., engineer, contract to Miller-Baxter Co., Inc., Indianapolis, Ind., 133 miles of line, 370 members; bid, $97,405.

Georgia — Snapping Shoals Electric Membership Corp., Covington, Homer Cook, supt., and J. B. McCrary Engineering Corp., Atlanta, engineer, contract to J. R. Cothran, Jr., Atlanta, Ga., 125 miles of line 322 members; bid, $69,880.

Illinois—Eastern Illinois Power Co-operative, Paxton, Terrence M. Brady, supt., and Laramore and Douglass, Inc., Chicago, Ill., engineer, contract to Contracting and Material Co., Evanston, Ill., 511 miles of line, 1,130 members; bid, $386,630. Norris Electric Co-operative, Newton, Merle D. Yost, supt., and Arnold L. Colpitts, Annex Hotel, Newton, Ill., engineer, contract to the Miller Construction Co., Indianapolis, Ind., 735 miles of line, 1,805 members; bid, $560,305.

Kansas—Sedgwick County Electric Co-operative Assn., Goddard, J. W. Guthrie, supt., and E. T. Archer & Co., Kansas City, Mo., engineer, contract to Ofstie Construction Co., Spring Valley, Wis., 197 miles of line, 357 members; bid, $121,645.

Kentucky—Big Sandy Rural Electric Co-operative Corp., Prestonsburg, Ray W. Chanaberry, Inc., Realty Bldg., Louisville, Ky., engineer, contract to D. L. Walker & Co., Lexington, 150 miles of line, 495 members; bid, $102,241.

Minnesota—Faribault County Co-operative Electric Assn., Frost, Carl Schneider, supt., and United Engineering Service, Minneapolis, engineer, contract to Franzen Brothers, Palisade, Minn., 180 miles of line, 289 members; bid, $97,674.

Missouri—Nodaway-Worth Electric Co-operative, Inc., Maryville, Earl W. Williams, supt., and Paulette and Wilson, Topeka, Kans., engineer, contract to Jensen Construction Co., Des Moines, 412 miles of line, 749 members; bid, $275,970.

Ohio — Tuscarawas-Coshocton Electric Co-operative, Inc., Coshocton, Lewis Buehler, supt., and Gibbs and Hill, Inc., New York, N. Y., engineer, contract to Paul L. Gilmore Co., Columbus, Ohio, 140 miles of line, 429 members; bid, $102,087.

Pennsylvania—Adams Electric Co-operative, Inc., Gettysburg, Calvin Cluck, supt., and Gibbs and Hill, Inc., New York, N. Y., engineer, contract to Miller-Baxter Co., Inc., Indianapolis, Ind., 327 miles of line, 564 members; bid, $227,475.

South Carolina—Aiken Electric Co-operative, Inc., Aiken, T. W. Henderson, supt., and engineer, contract to Wheatley and Mobley, Augusta, Ga., 76 miles of line, 191 members; bid, $42,322.

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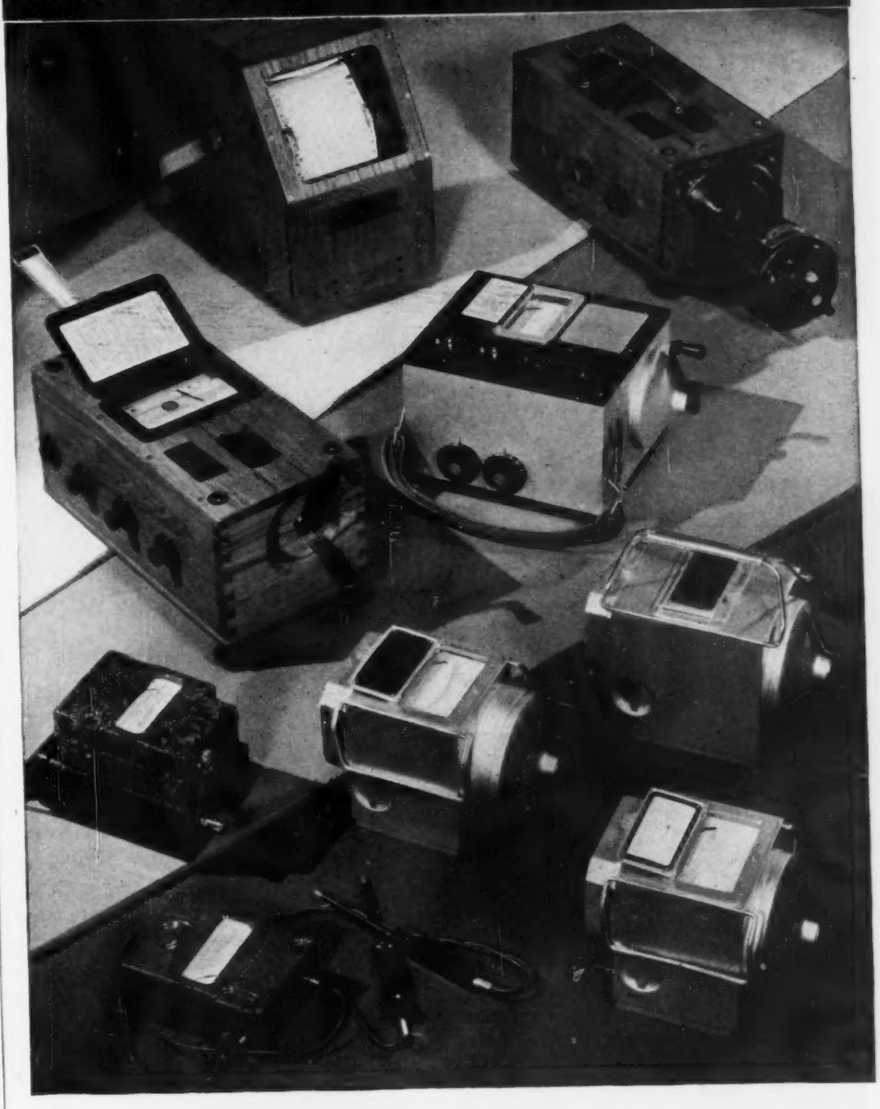

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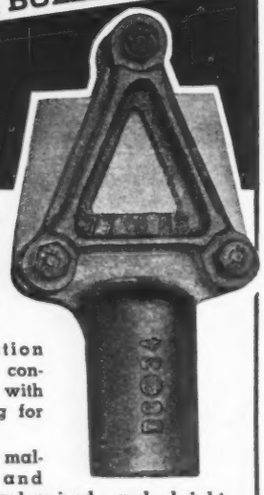

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Frame Vibration Reduced on Waterside Generator

[*Continued from page 39*]

the final installation, the ratio between the amplitudes at "no field" and "full field" will remain about the same. Because various foundations do alter magnitudes of measured vibrations it is impractical to predict "on the job" values.

Cure of this old vibrational problem should bring welcome relief to electrical power producing industries. Two-pole, high-speed machines are ideal for expansion of capacity in existing steam plants because of their inherent smaller size per kva. output. In many cases, however, concern was felt over their use because of the ever-present problem of vibrational effects on plant equipment such as meters, relays, etc. Assured of no ill vibrational consequences by use of the resilient stator suspension, the two-pole, large-capacity machine may well become more popular.

Sodium Lighting Permits Continuous Canal Traffic

[*Continued from page 47*]

structural elements of the bridges. Luminaires are mounted 25 ft. above the roadway, in parallel arrangement. Average intensity of illumination on the roadway approximates 1.00 lumen per square foot. The lighting on each bridge is operated from separate constant-current regulators located in transformer vaults in the bridge abutments. The series circuits run under the bridge and each lamp is operated on an isolating current transformer, so that low-voltage secondaries of 28 volts feed each individual lamp. The cables to each lamp are secured by straps attached to the lattice type of steel uprights. This arrangement avoids any serious damage due to tampering with these cables. Bridge lights are operated by a light control cell. There are 24 luminaires on the Bourne bridge and 28 on the Sagamore bridge.

Traffic through the canal is controlled by light signals at each approach. An airway traffic control signal has recently been installed at Wings Neck for the control of the ships. This signal employs 1,000-watt lamps back of each lens, has a spread of 180 deg. and is particularly effective.

This development is a noteworthy achievement on the part of the engineers of the U. S. War Department.

LETTER TO THE EDITOR

Lighting Performance Specifications Urged

To the Editor of ELECTRICAL WORLD:

Specifications for lighting installations drawn by engineers for private work, and especially engineers on public work, have progressively degenerated until they are now so loosely written that interior equipment is usually supplied on the job at the expense of the owner—the cheapest is the best. Some years ago engineers designed lighting installations around some particular type of material and specified outright by catalog number the equipment desired. Manufacturers not specified registered complaints with the engineers directly or indirectly. Engineers then loosened their specifications, using only types of equipment in their design that could be furnished by the majority of manufacturers and ignoring specific equipment that might not only do a better job but might effect a considerable economy in operation. This practice has now reached the place where engineers specify not what best serves their clients' interest, but that which will keep the majority of the equipment manufacturers quiet.

This prostitution of the engineering profession could well be ended if engineers would adopt a different point of view; *i.e.*, consider the interest of their clients more and make the interest of the equipment manufacturers secondary. After all, this point of view should work no hardship on the equipment manufacturer because it is his province to manufacture what is required to meet good engineering practice.

In the interest of the client and good engineering practice—the maximum service at minimum cost—engineers should write function (performance) specifications instead of form (fixture) specifications. The customer is not primarily interested in fixtures or even illumination, but he is interested in what the illumination will accomplish for him, such as more work, better work, less spoilage, fewer accidents, more sales, less returned goods, better morale, advertising value, etc. Lighting specifications prepared by engineers both for private and public work should specify definitely the following:

Illumination in foot-candles (on horizontal or vertical plane as required).
Uniformity.
Maximum amount of glare.
Maximum kw. allowable.
Maximum allowable dust and dirt depreciation.
Maximum permanent depreciation.
Penalty for furnishing equipment not meeting the specifications.

Such a specification would best secure the interest of the client, and the engineer and the lighting manufacturer would have no grounds for legitimate complaint because the business would go to the lowest bidder who would guarantee to meet the performance specification.

DAVIS H. TUCK,
Electrical Engineer
Holophane Company, Inc.,
New York, N. Y.

•

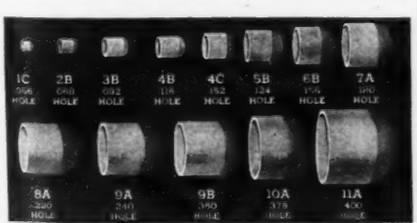
Restrain Competitive Unit

Missouri Public Service Commission has ruled that an "individual" cannot "invade the field of an authorized utility" and ordered the Cirese Power & Light Co. to quit selling electricity in Kansas City. Kansas City Power & Light Co. complained that Cirese was invading its territory without a permit and maintained that he had started supplying his own apartment buildings and then offered power for sale to other residents of the neighborhood.

•

Allen Heads Board

Major Thomas H. Allen will become president of the Memphis Light, Gas and Water Division, and J. J. Brennan, now director of promotion, will be named vice-president and the new member of the board, Mayor Walter Chandler has announced. Major Allen takes the position left vacant by the death of W. W. Mallory. Mr. Brennan is succeeding Major Allen as vice-president.



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Commercial Saturations Boosted by 5-Year Plan

[*Continued from page 49*]

with its price, terms and wiring costs.

One smart procedure was followed by salesmen in inviting prospects to take a ride to a near-by town to see some recent installation. This courtesy gave the salesman a wonderful opportunity to discuss the many sales points of electric cooking or baking at a time when the prospect was relaxed and not worrying about his business, and was thus in no position to turn a deaf ear to ideas and suggestions. At the end of the pleasant ride the prospect personally interviewed the user and received first-hand information which verified statements given him earlier by the salesman or by direct mail.

Sales arguments that proved effective for company salesmen in the northwest were: (1) The use of all-electric kitchens materially reduces the temperature in dining rooms, thus adding to customer comfort and reducing costs of air-conditioning equipment, at least as to operation; (2) working conditions are much improved because of the absence of heat and handling of combustion fuels; (3) durability of electric equipment is 50 to 100 per cent greater; (4) savings are made in cleaning and redecorating; (5) savings are made in meat shrinkages when roasting in electric ovens, and more uniform frying is achieved; (6) convenience is realized in having heat when wanted and at the temperature needed; (7) the maximum increase in costs created through the use of all-electric cooking equipment is but 1 per cent of gross sales, and the savings as indicated by many advantages more than compensate for the slight increase in operating costs.

Water Heating Too

It was a natural step to follow the more than satisfactory increase in cooking equipment sales with a story on the advantages of electric water heating, even though sale of a water heater is one of the most difficult problems in the sale of an all-electric kitchen because it means the elimination of the present hot-water tank. These tanks may vary in size from 52 gal. to 220 gal., and the price involved may range from $104 to $230, less installation costs. Several advantages were found effective in the sales argument.

These advantages are as follows: (1) Removal of tank from kitchen to basement, allowing for more working space. (2) Maintenance at all times of proper water temperature. (3) A considerable saving in repairs to pipe lines and water faucets. (4) Convenience of having hot water when work was started early in the morning.

Approximately 75 per cent of the company commercial business, as it pertains to all-electric restaurants, has been obtained since the company initiated its organized sales program. We believe that by following our plan still further, the future will see nearly 100 per cent electrification.

After making an analysis of commercial accounts, we find that the average amount received per kilowatt-hour from those establishments using all-electric cooking and baking is approximately 1.7 cents and the average amount received per kilowatt-hour from water heating is 8 mills. Further analysis of these rates indicates that the company's annual return per kilowatt connected is $22.19 for cooking and $29.82 for water heating.

•

Oklahoma Board to Order Electric Rate Cuts

A reduction in electric rates of the Southwestern Light & Power Co., Tulsa, Okla., will be ordered by the state Corporation Commission, effective January 1, Reford Bond, chairman, has announced.

Residential and commercial rates were included and Chairman Bond estimated an annual saving of $100,000 to customers of the company. He said the reduction was agreed to after investigations. Details of the new schedule were being worked out by the commission's staff and engineers of the company.

He also announced a reduction of $1,660 or 6.8 per cent annually in electric rates for customers of the Oklahoma Power & Water Co. at Sand Springs.

•

Affiliate Gets Dividend

Edison Light & Power Co., York, Pa., has been permitted by the state Public Utility Commission to pay a dividend of $124,750 to York Railways Co., an affiliate.

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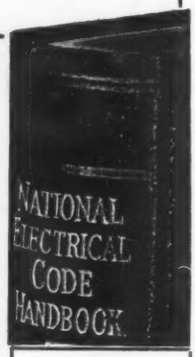

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BOOK REVIEWS

Materials Handbook

By George S. Brady. Fourth edition. Published by McGraw-Hill Book Co., 330 W. 42d Street, New York City. 591 pages. Price $5.

A former American foreign trade commissioner initiated this book to fill his own needs. This fourth edition represents a continuous evolution of the compilation of materials of industry. Chemical compounds, alloys, synthetic products, diversified metals and obscure basic resources are becoming so much a part of all process industries and fabrication that few can even know the rudimentary properties and potentiality of any great number of them. This book should be useful to electrical engineers if they want quickly to find out about alumina, brazing metal, cerium, tantalum, vulcanized fiber, zirconium or hundreds of alphabetically intervening products.

•

Matrix and Tensor Algebra for Engineers and Chemists

By Clarence E. Rose. Published by Chemical Publishing Co., Inc., New York. 143 pages, tables. Price $4.

Tensors can hardly be ignored by electrical engineers who expect to remain conversant with the mathematical tools of a decade hence. The author, a Navy engineer, has linked together here in basic, connected manner the calculus, determinants and tensors so that the average engineer ought to bridge the gaps left in other treatises. In this way it elucidates how a determinant array can represent independent but related quantities. From there the book shows how three-dimensional matrix algebra can coagulate volts, amperes and impedances into an apparently hopeless tangle, but subsequently unscramble them all with new light on their interactions. One really distinctive feature about the book is the index; from it one can quickly find any process and the ruling forms of expression accompanying it.

•

Steam Power Stations

By Gustaf A. Gaffert. Published by McGraw-Hill Book Company, Inc., 330 W. 42d Street, New York City. 582 pages, illustrated (including two steam charts). Price $4.50.

New material on high-temperature, high-pressure plants and on plant costs have been added in this revision of a book which as before deals primarily but not exclusively with public utility generating stations.

Economics, thermodynamics and equipment principles have been nicely balanced to give a student or a practicing engineer an orderly view of the precepts which are guiding current practice. The thermodynamic subject matter is compactly presented and so fortified with numerical solutions of typical examples as to afford the electrical engineer a competent source of information as to what lies behind the shaft to which he couples his generator; more important, how the steam engineer reaches his decisions aimed toward making kilowatts reliable and kilowatt-hours as inexpensive as practicable.

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(Continued on opposite page)

CHALLENGE TO INDUSTRY'S PATRIOTISM

Calls for Plain Speaking

IT is a pity that the greatest national defense effort in American history had to be made during a presidential election campaign. For a modern defense effort involves an intensely practical industrial project, while an election campaign involves an intensely emotional political propaganda. And those two don't mix.

That, as I see it, is the chief reason for the welter of claims and denials, charges and counter-charges that have been getting in the way of contracts for planes, tanks, guns and all the rest of the armament for which the American people are so nervously peering down the road.

We are told that the managers of industry, smarting and suspicious under the repeated attacks of government officials for some years back, have been reluctant to assume the abnormal risks of defense contracts without commensurate safeguards, and that the politicians who must authorize those safeguards have been reluctant to do anything that might be construed as letting down the bars for unscrupulous business men to exploit the national emergency. For the one, the business risks of full speed ahead have been too great; for the other, the political risks of full speed ahead have been too great. So we don't go full speed ahead.

This is not written to increase that clamor of recrimination on either side. On the contrary, it is an appeal for some decent and thoughtful consideration on the part of all concerned—consideration for the urgent needs of the nation, for the problems and responsibilities of both the politicians and the industrialists, for the elementary principles of prudent business management, and for the good opinion of the man on the street. He is neither a politician nor an industrial executive. But his hide and his pocketbook are at stake in the national defense program—and he knows it. He has a right to the low-down on what is going on. And if he is left in ignorance or deliberately deceived, for the sake of either political or business whoopee, the payoff will be mighty poisonous political medicine for the politicians and equally poisonous business medicine for the business men who may be responsible.

* * *

The plain stark fact, to be faced squarely by us all, is that the national defense program is an emergency project—a desperately urgent emergency project.

As in every emergency that confronts a democracy, we are harassed by a confusion of counsel. As always, some of the confusion arises from honest but conflicting judgments, some of it from ignorance or muddy thinking. But, unhappily, much of it reflects the deliberate purpose of self-seekers to fish in troubled waters—to capitalize the conjunction of a national emergency and a political campaign to boost their own interests. Already the charge that American business men are unpatriotic and interested only in profit has been put out as a smokescreen to cover up deficiencies for which business men are in no way responsible.

Now the man on the street finds it hard to see through this maze of excited contradiction. Not because he isn't smart—the average American can think straight enough *when he has the facts.* But in this case the facts are obscure and complicated—they have to do with matters that are strange to him. And to make it worse, at the height of his confusion, raucous voices constantly assail his ear with "simple" explanations of it all. But, as so often happens, most of these "simple" explanations make the matter a lot simpler than it really is.

* * *

Consider, for example, the cry that "industry refuses to get busy on national defense until its profits are guaranteed". Very clear and simple, to be sure; but also very false. The charge that American capital is "on strike" in the hour of national need. As silly as it is simple. The assertion that our manufacturers "won't even talk with a government anxious to place orders with them, without large financial concessions", and that "American corporate industry refuses to expand its resources for defense until it receives immunity from proper taxation". The resounding demand that we "conscript wealth as well as men"—whatever that may mean.

Particularly political has been the attack on the aircraft industry. It has been made to appear that aircraft manufacturers were instituting a sit-down strike because, in their greed for profits, they demanded more than 8%. Actually the 8% was not a net profit at all and the only concern of the manufacturers was to fight against incurring losses under the 8% limitation. And army and navy officers have sustained the aircraft manufacturers' viewpoint.

The air is full of explanations which, however simple they may sound, do not explain. And in most cases, I am convinced, the purpose of those who offer them is not to explain but to inflame. Those who try honestly to explain these issues from either side, find it impossible to do the job in such ringing phrases.

As I have said, our country has been caught short. As

a result, there are many reasons for the confusion and controversy. The plain fact is that we can produce our war equipment by only two means: (1) by converting the industries of peace into the industries of war, so far as that is possible; and (2) by building from scratch the new facilities we need to supplement them. In other words, we must create—with desperate haste—a new industry in America—an armament industry.

Right there is the crux of the problem that now confronts the industrialist sincerely trying to equip himself for his part in national defense. For this new armament industry is not the ordinary business risk against which he has learned to weigh the interests of his employees and his stockholders. It does not deal with familiar products and processes. It is not continuous—at least it has not been heretofore in this country—and it may fold up as suddenly as it has opened. It cannot hope to serve thousands of potential customers: it has but one sure customer—the United States Government—and wielding the sovereign power that customer can do just about as it pleases with respect to its needs and demands. Which means that not even this one is a *sure* customer.

* * *

No more unfair or deceptive charge ever has been leveled against American industry and American business men than the accusation of being unwilling to take the normal business risks of the defense program. The risks they are trying to minimize—they cannot possibly avoid them all—are very special and extraordinary risks indeed. So clearly is that true, that I doubt very much whether such questions and charges ever would have risen were it not for the fact we are engaged in a political campaign.

Already some of industry's great units have gone ahead with the building of new facilities, the purchase of special materials, and the actual production of armament in the face of all risks, gambling that their government eventually would work out some reasonable plan to protect them against excessive loss. Others, doubtless will follow suit.

But many other companies, for one reason or another, are not in position to do that. So before they begin to expand their facilities to handle defense contracts, they have asked their *only potential customer for those new facilities* to guarantee them—*not* excessive prices, *not* exorbitant profits, *not* immunity from taxation, as we are being told, but simply against the excessive losses that may result from very extraordinary conditions.

* * *

As this is written, it looks as though the legislation and the rulings necessary to accomplish this purpose soon will be forthcoming. Thoughtful and responsible officials of the government understand the situation and what is needed. But, unfortunately, their understanding and action will not quiet the professional business-baiters. So long as those gentlemen have their own interests to serve, so long as political excitement makes it easy to whip up public demand for a scapegoat to atone for disappointing progress with the defense program—just so long will the business-baiters find a receptive audience for their criticisms.

All of which suggests that business men must carry at this time a double responsibility, in addition to their obvious obligation to do the very best job they know how on their individual parts of the defense program.

The first of these added responsibilities is, of course, to avoid any possible basis for the charge that industry is exploiting the defense program in behalf of excessive profit, unfair treatment of labor or any other unworthy self-interest. The second is to see that the man in the street knows and understands all that I have tried to set down in the foregoing.

For the man in the street is deeply involved in all this. He is "in the street" only to the political orators. To the rest of us, he is the man in the factory, the man on the truck, and the man behind the orders that industry fills. In short, he makes up this living American industry on whom the politician's charges spatter. As an employee he has a stake in the solvency, the security, and the reputation of the very plants at which criticism may be directed. Knowing the facts, he can answer the critics so far as his own plant is concerned and can see how the same kinds of facts apply to all industry. If he is a customer, suffering inconvenience as a result of the plant's service to national defense, a knowledge of the facts behind the plant's problems will help to make him a defender rather than a critic of responsible business management. If he is a neighbor in the community, the facts will equip him to be an interpreter of industry's problems to the people of the home town.

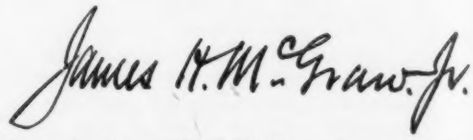
* * *

In this national defense effort, business enters into a new partnership with government, but, more importantly, into a deeper partnership with the American people. It is more than ever essential that it take all of the American people into its confidence, beginning with the people in its plants and going out through the ranks of its customers and its community neighbors to show them that they have a common interest in seeing that the task of national defense is undertaken in the American way.

As we all know, there are in this country some people who would like nothing better than to see American industry fail in this supreme test of service to the nation. They will watch with jealous eyes every move of every company that is engaged on a defense job. They will disparage its achievements, exaggerate its shortcomings, and distort its motives. For they would like to make over American industry to their own pattern, and they'll never have a better chance to get started with it than has been opened up by the national emergency. Or so it looks to them.

So, great as are the business hazards of the defense program for the individual business man, even greater hazards are involved for American industry as a whole. But, knowing the temper of American industrial leadership as I do, I am confident that it will handle its defense assignment with credit to itself and with great advantage to the nation that it serves—whether in war or in peace.

To help in that supreme test is the opportunity and the privilege of the McGraw-Hill organization.



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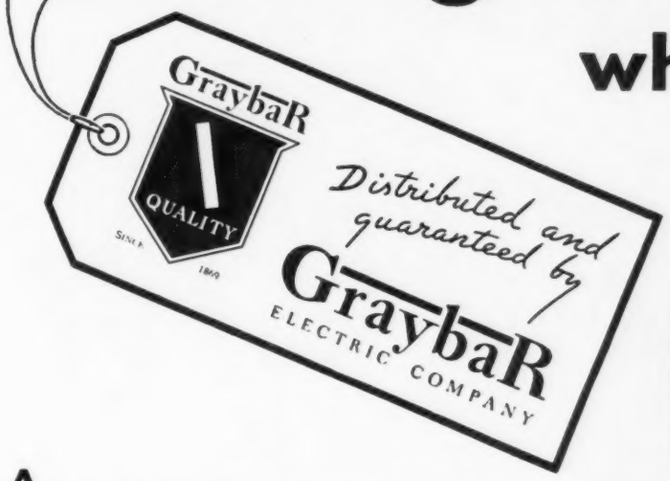

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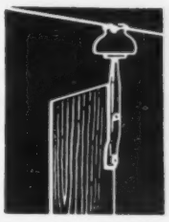

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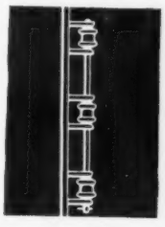

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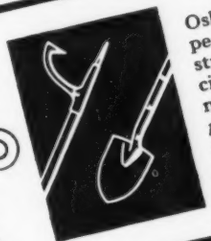

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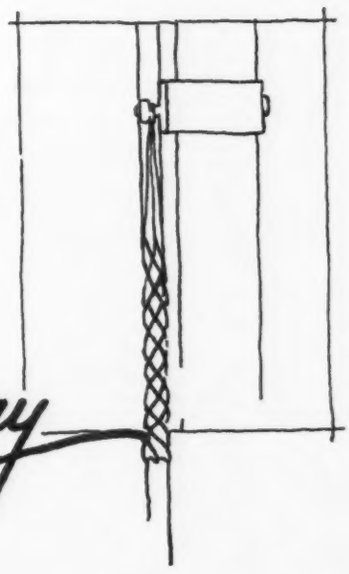

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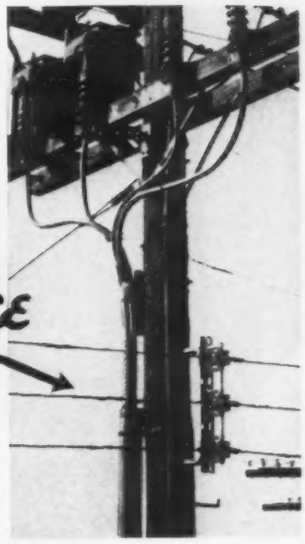

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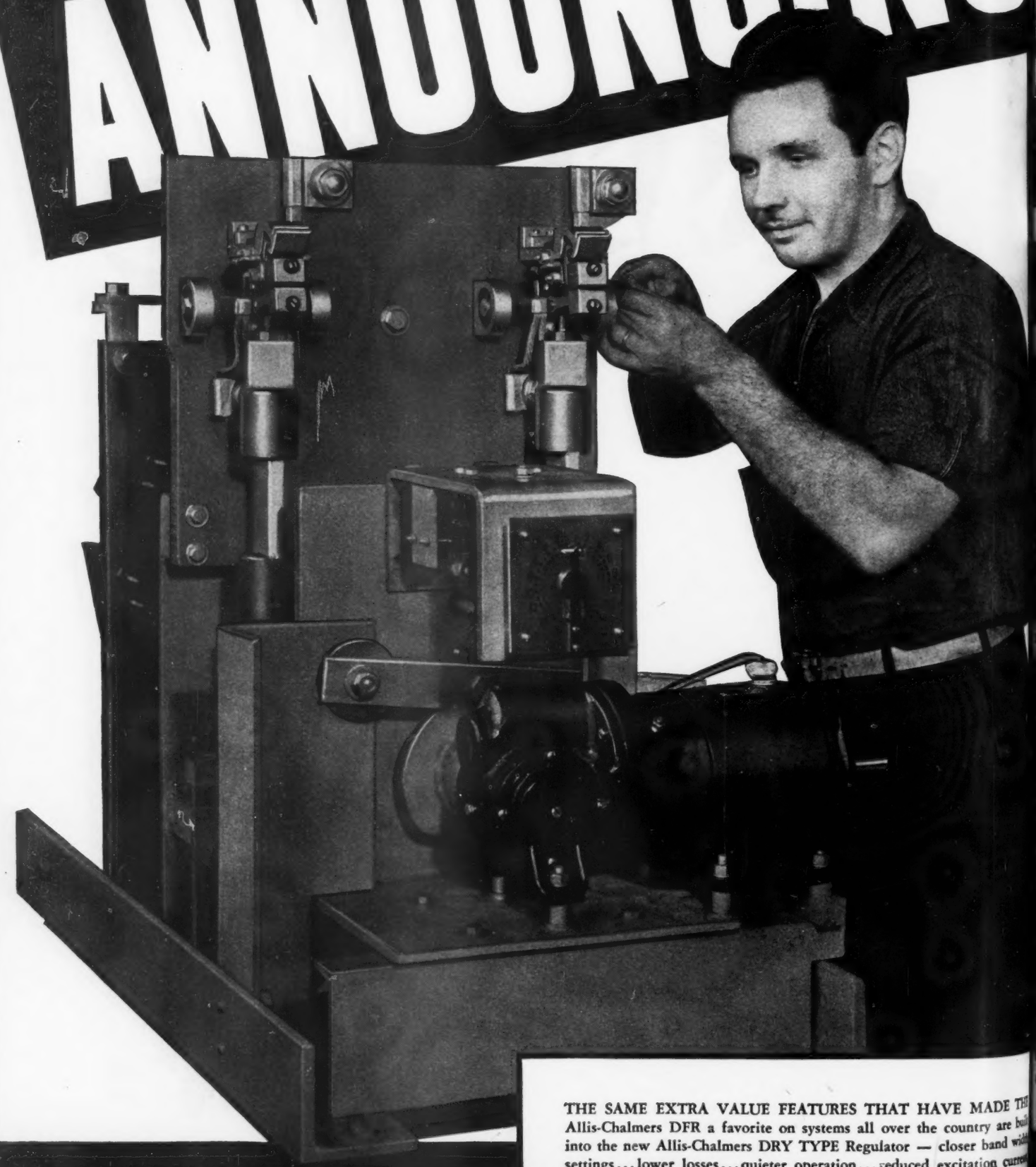

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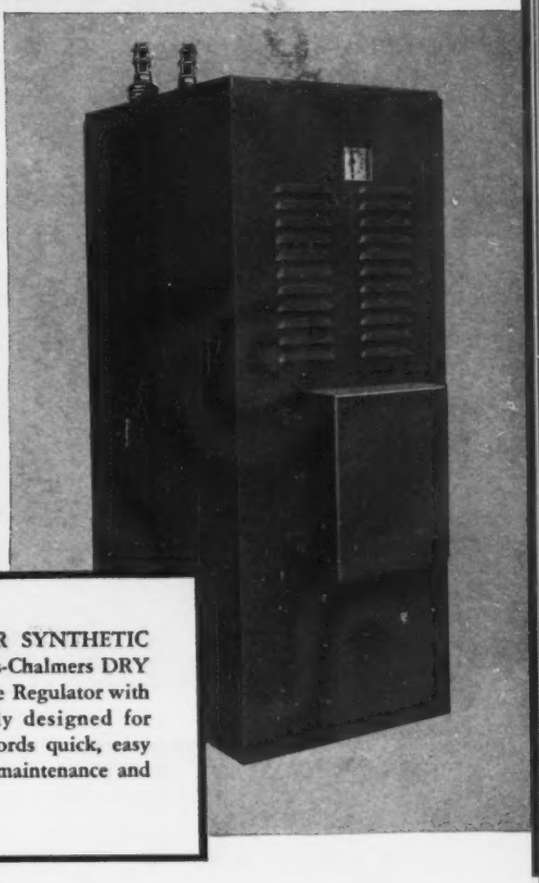

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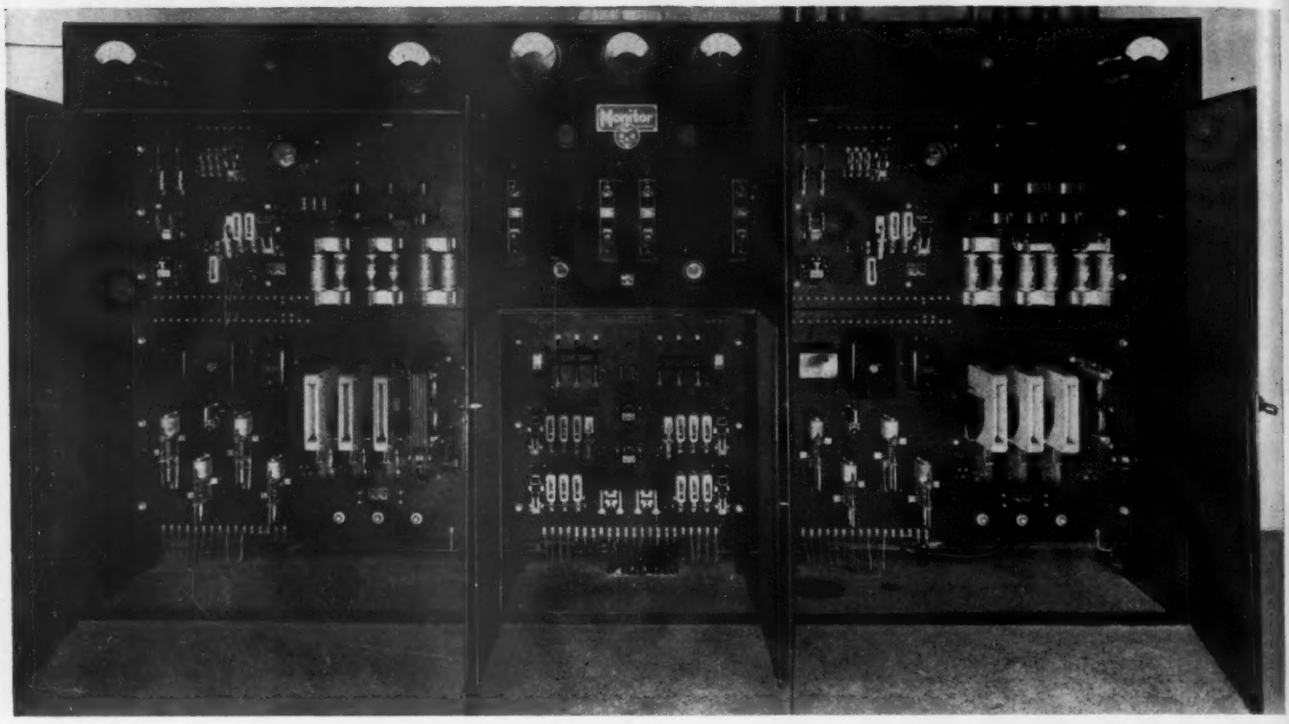

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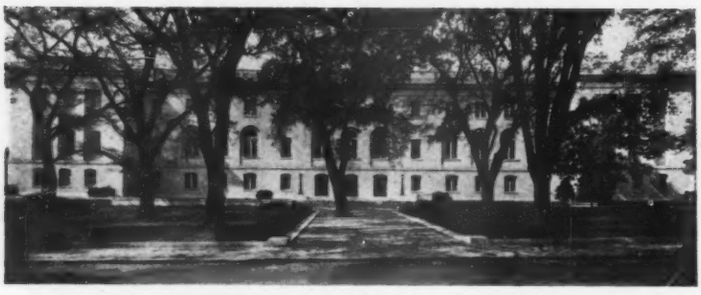

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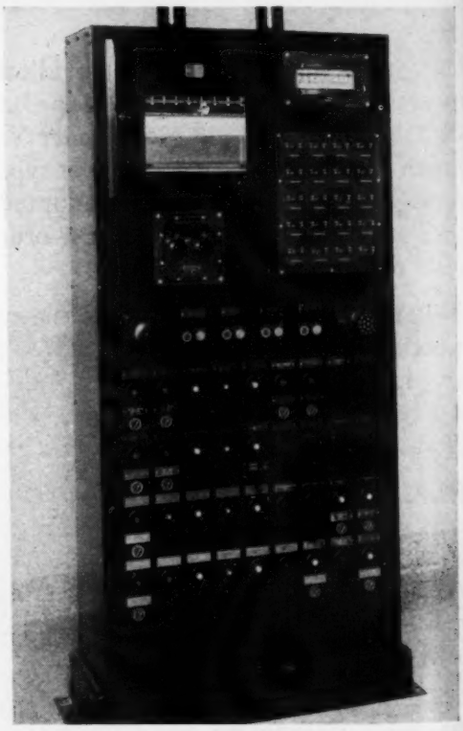

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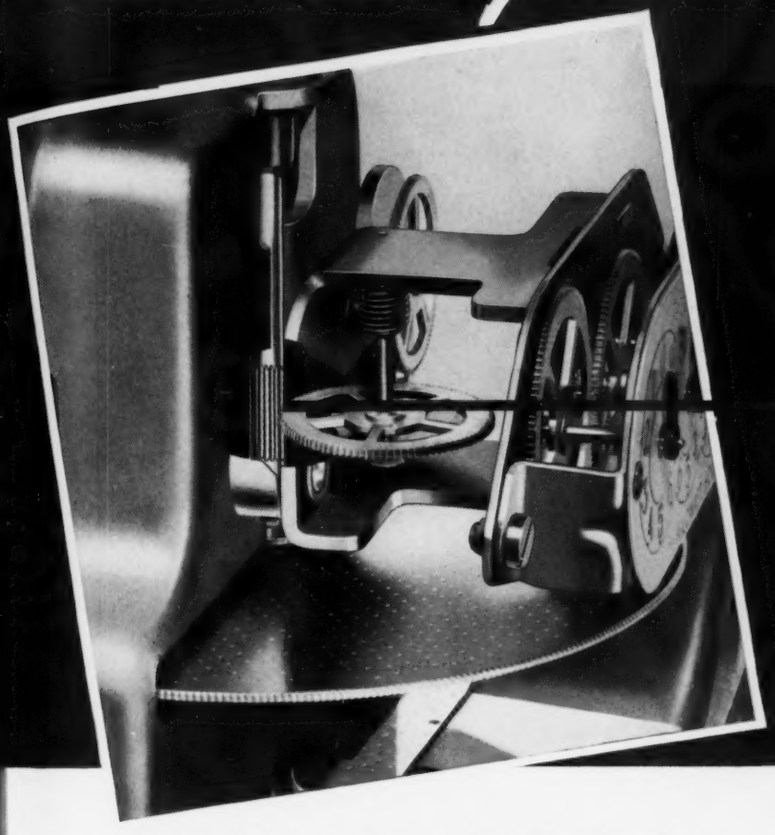

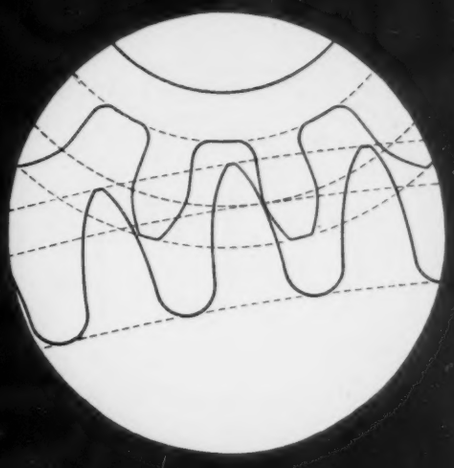

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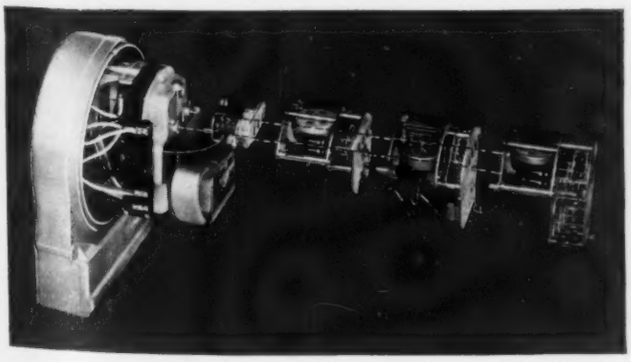

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J-40263

Westinghouse Meters

HOW THE C-S-P

● A SUBSTATION IN A COMPACT UNIT
● SAFE RESERVE CAPACITY
● POSITIVE BACK-UP PROTECTION

The C-S-P Power Transformer is a complete substation in a single tank. That alone means a saving in installed cost—compared to the cost of the ordinary substation.

But the C-S-P Power Transformer is an entirely different *kind* of substation because it incorporates the proved operating principles of C-S-P Distribution Transformers. These principles provide a new standard of substation service and protection.

TWO NEW PRINCIPLES OF POWER TRANSFORMER OPERATION

1. SAFE RESERVE CAPACITY—Now you can provide peak load capacity at no risk to the transformer, for C-S-P overload protection considers the *duration* as well as the *magnitude* of overloads.

Only when both combine to produce a dangerous winding temperature do the thermal relays function, first giving a warning, then tripping the switch which removes the load from the transformer. Peak loads are safely handled and needless service interruption is eliminated.

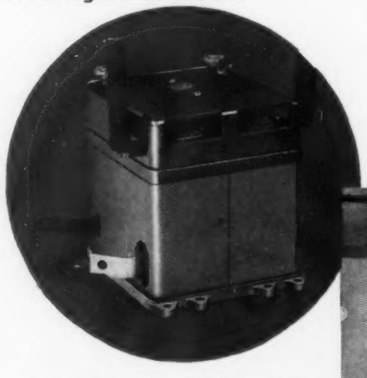
2. POSITIVE BACK - UP PROTECTION — C-S-P Transformers are provided with exclusive protective links which automatically disconnect the transformer from the line in the event of internal distress from any cause.

Normally not affected by surges, overloads, or short circuits, these links may never function, but they are always ready to protect the transformer equipment as well as any other apparatus on the same line in case of trouble within the transformer.

With protective links as "back-up protection," service to other transformers connected to the same feeder will not be interrupted due to trouble at the C-S-P.

Get Complete Details on this new transformer—the Completely Self-Protecting Substation in a single compact unit. Be sure you understand the full advantages of the C-S-P principles. Call or write the nearest Westinghouse office.

J-70252



THERMAL RELAYS (left) proved by service in thousands of C-S-P Distribution Transformers, act instantly to protect the transformer in the event of dangerous winding temperature.

OVERLOAD LIGHTS (right) located in the control cabinet give warning of overload in any phase before a dangerous temperature is reached. This 24-hour-a-day load supervision is based on winding temperature.

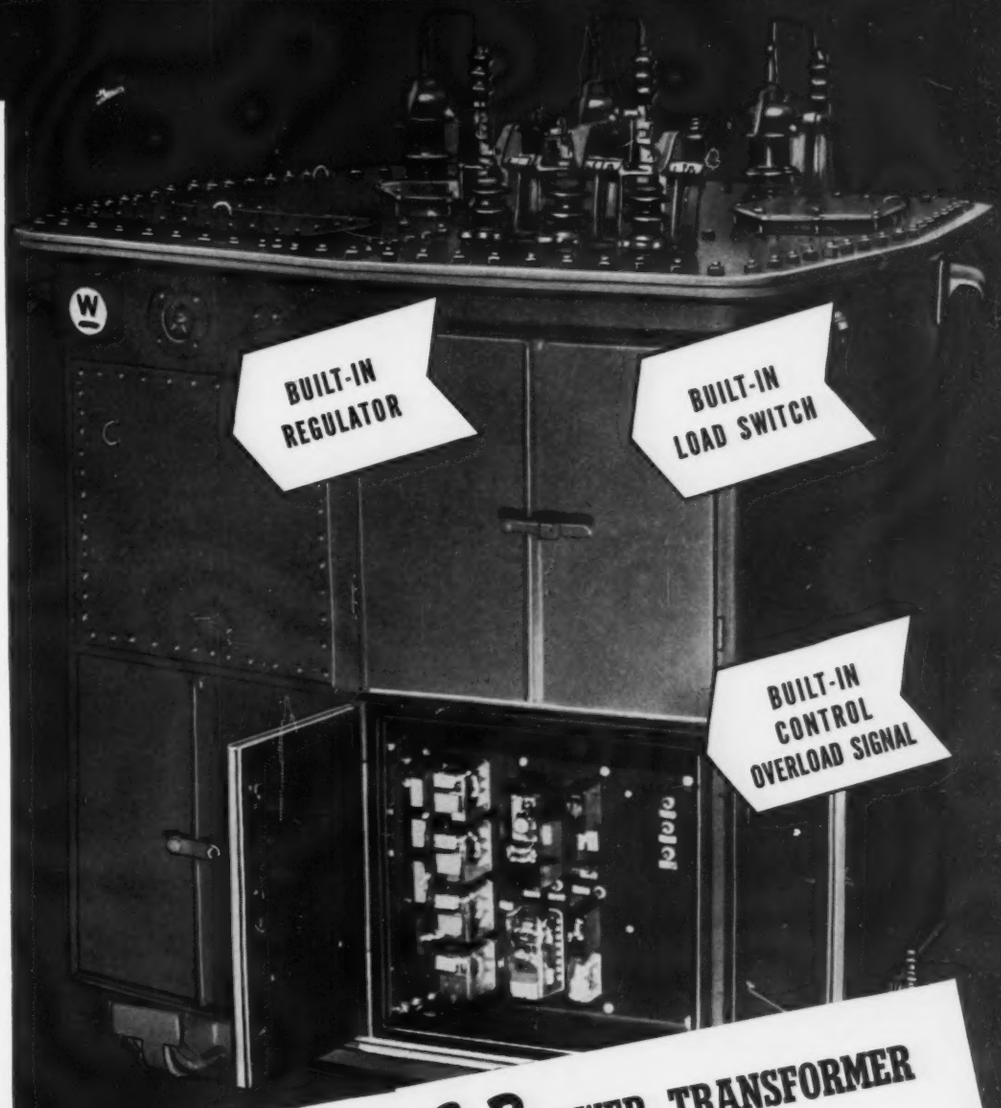
Westinghouse

POWER TRANSFORMER

DIFFERS FROM ALL OTHERS

HOW YOU SAVE WITH C·S·P POWER TRANSFORMERS

1. ***Smaller investment***—installed cost less than for typical substation performing the same functions.
2. ***Lower operating cost*** — small maintenance cost beyond periodic inspection.
3. ***Improved service*** — no lost revenue from outages due to lightning or short-time overloads.
4. ***Quick installation*** — factory assembled and tested. Comes complete in a single package that can be installed, put in service, in a day.
5. ***Uses less space*** — lower real estate rental or purchase cost.
6. ***Greater flexibility***—easy to move if load center shifts.
7. ***Unit responsibility*** —Westinghouse delivers the complete job, ready to install.
8. Install it any season of the year. Little installation work to do.

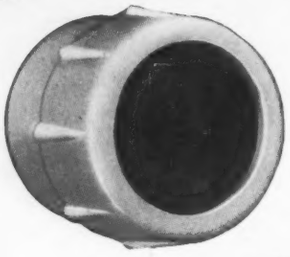


THE C·S·P POWER TRANSFORMER
A COMPLETE SUBSTATION IN A SINGLE TANK

RATINGS:
500 through 3000 Kv-a. High Voltages 69000 Volts and below

Transformers

C·S·P TRANSFORMER *gives you* "EASY CHAIR" LOAD SURVEY



SIGNAL LIGHT—Gives instant warning when an overloaded condition exists in the transformer—providing free load survey.

BREAKER—Operates only when overload reaches dangerous proportions. Permits temporary overloads without interrupting service.

C·S·P

IS THE ONLY TRANSFORMER PROVED BY LIGHTNING

As a final test, every C-S-P Transformer is given a lightning stroke—800,000 volts and 65,000 surge amperes—your assurance of a transformer that will stay in service.

C-S-P has a record of 99.66% PERFECT PERFORMANCE in the service of almost a thousand power companies.

SIGNAL LIGHT SAYS "WATCH"

The instant there is an overloaded condition on any C-S-P, the signal light comes on to say, "This transformer is doing too much work." If the overload is relieved, light can be reset without interrupting service. Should the overload reach dangerous proportions, the built-in breaker opens the circuit—protecting the transformer.

BREAKER HALTS OVERLOAD DAMAGES

Here is, in effect, a free load survey, plus 24-hour-a-day overload protection. The transformer cannot burn out—the breaker won't permit that.

Many power companies are saving money every year by using this form of load survey, which is safe, sure and positive. It not only avoids the cost of periodic load surveys, but prevents unnecessary transformer changes and assures maximum use of transformer capacity. It also protects against service interruptions that mean customer dissatisfaction.

PLUS THESE C·S·P ADVANTAGES

The C-S-P Distribution Transformer is the only one that provides:

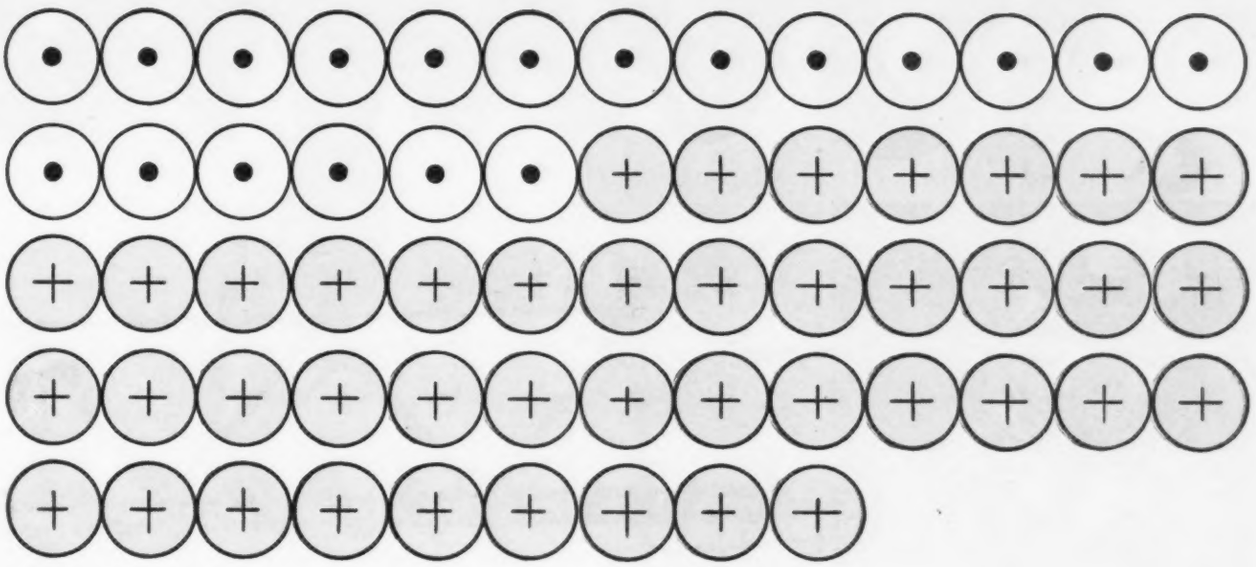
1. Complete self-protection against service interruptions from fuse outages.
2. Complete self-protection against lightning.
3. Complete self-protection against burnouts from short circuits.
4. Complete self-protection against burnouts from overload.
5. PLUS, simplified installation, low cost construction, and lower maintenance cost, for every year of service.

Ask any Westinghouse man to give you complete details.

J-70239

Westinghouse Transformers

Invest in LATOX CABLES



(+) = YOUR DIVIDENDS

Imagine that you have a 19 conductor #16 solid rubber insulated control cable in a conduit. Under ordinary conditions of conduit fill it would require a 1¼ inch conduit. Suppose also that your 19 conductors are all in use and you need more circuits.

If you replace your present cable with a LATOX insulated control cable with #16 solid conductors you can get 61 conductors or more than three times the number of conductors you now have, yet the Simplex-LATOX cable will not take up any more space than the one you are now using. The extra 42 conductors are your dividends. The 61 conductor LATOX cable can go into the same 1¼ inch conduit. It is the simplest, easiest and least expensive way to increase the service capacity of your control cables and conduits.

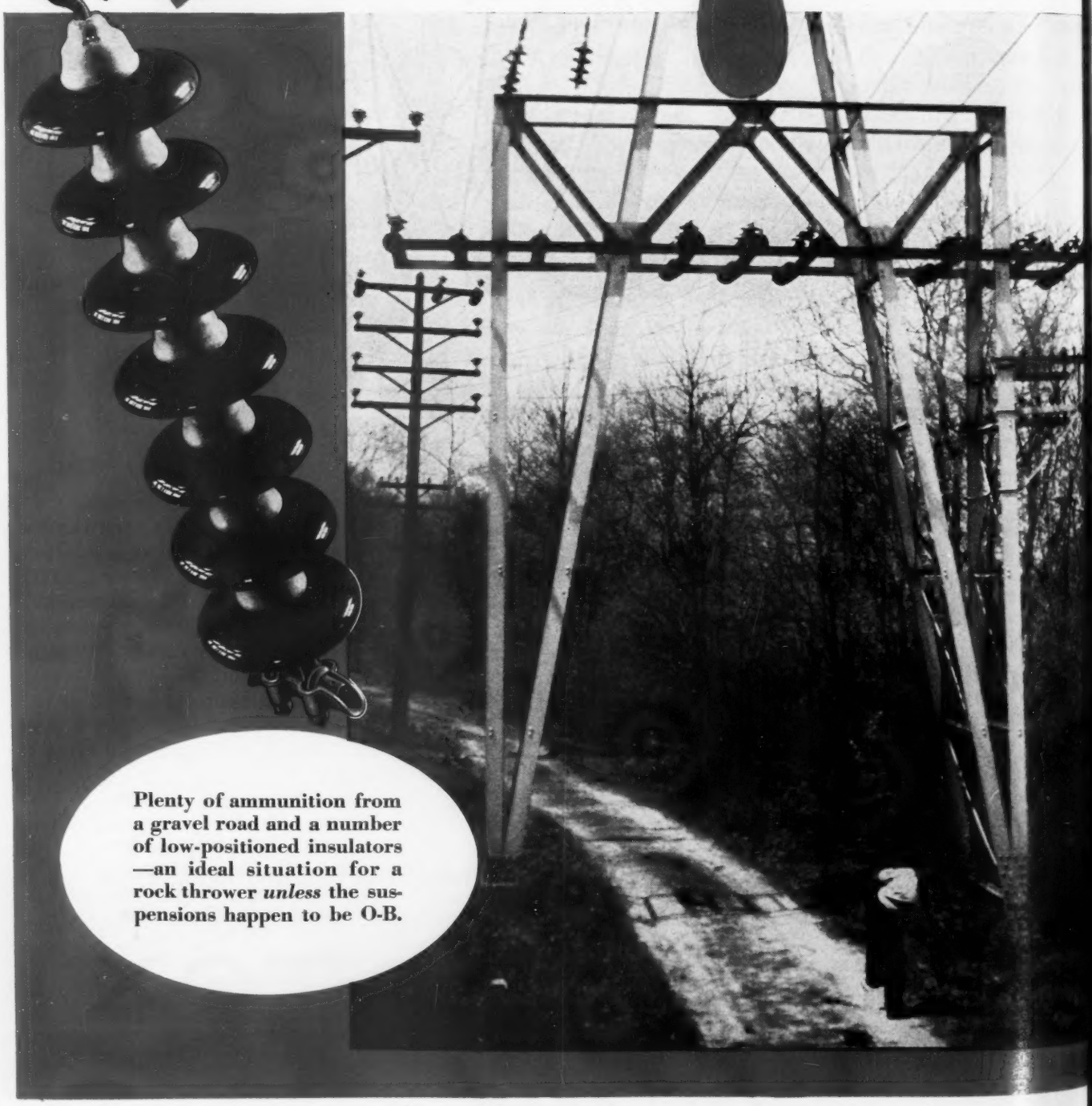
We shall be glad to send you a copy of our new LATOX Data Sheet #101, which is just off the press. A card or a letter will bring it to you promptly.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

Simplex – LATOX

Thin insulation made directly from rubber latex

Tough



Plenty of ammunition from a gravel road and a number of low-positioned insulators —an ideal situation for a rock thrower *unless* the suspensions happen to be O-B.

Enough

TO WITHSTAND ABUSE

● Victims of rock throwing, gun fire, rough handling, falling tools, and even lightning, suspension insulators have a high mortality rate on many properties. But you can reduce this breakage to an absolute minimum by using O-B's extra-tough units. Huskitypes with petticoats, for example, are provided with unusually high impact resistance for withstanding rock throwing and rough handling. Huskitypes without petticoats allow bullets to ricochet off the smooth under surface without damage. And several of O-B's standard suspensions are made with thicker sections of porcelain to minimize breakage from all causes. Although designed to stand greater abuse, these rugged insulators have all of the life-prolonging features for which O-B suspensions are noted. And that combination, high impact resistance plus time-proved basic designs, is the most effective one known for reducing insulator losses—and their attendant costs!

Buy the Best ...Buy O-B

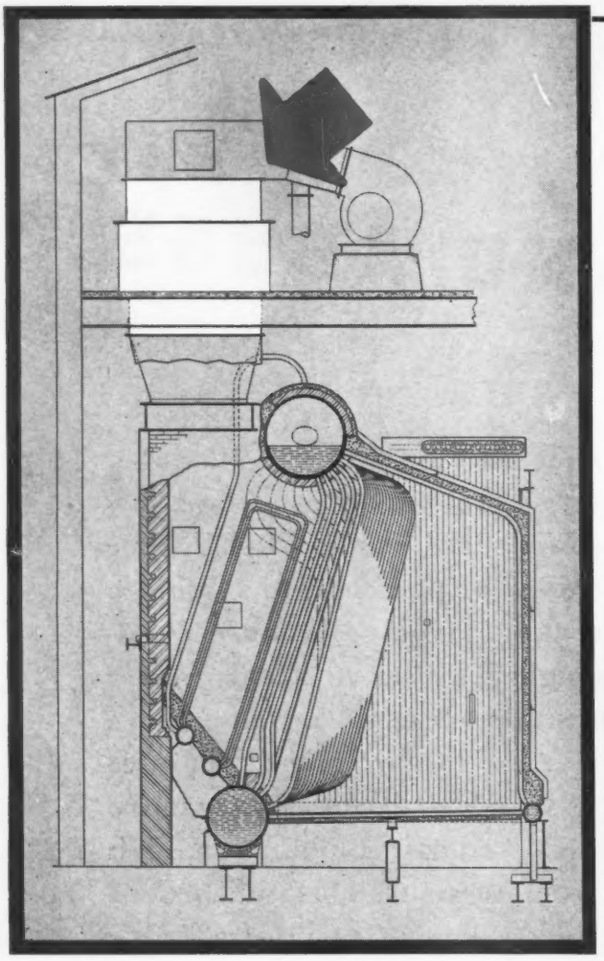
Ohio Brass

MANSFIELD, OHIO, U. S. A.

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont., Canada

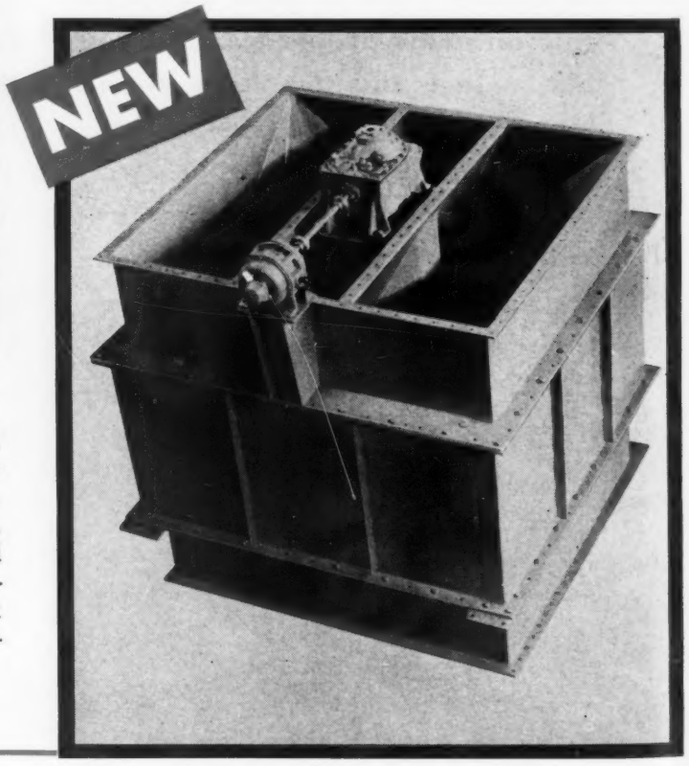
Chemical Formula For $avings: 3CGZX

3 Ljungstrom Air Preheaters (Type CGZX) Increase Efficiency of Moderate-Size Boilers at Chemical Manufacturing Plant.



The Ljungstrom Air Preheater is no longer limited in its economic application to high-efficiency steam generating units in the capacity range above 100,000 lb. steam per hr. With the development of this Type CGZX, first cost of the unit has been lowered to a point permitting wide application of the *continuous regenerative counterflow* principle to boilers in the 25,000—100,000 lb. per hr. capacity range.

In almost every installation calling for high levels of heat recovery, the economic balance is now likely to show a clear margin of advantage for the Ljungstrom. We welcome the opportunity to furnish the information necessary for a thorough engineering analysis of what's to be expected in any individual case.

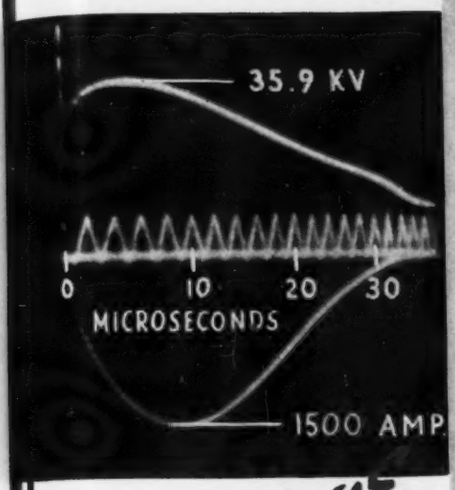


Steam generating units recently installed by this prominent chemical manufacturer operate at 250 lb. per sq. in. pressure, and have a maximum steaming capacity of 85,000 lb. per hr. each. They are designed for either oil or pulverized coal firing. When the boilers are operated at capacity, gases enter the Ljungstrom Preheaters at 730 deg. F., and leave at 428 deg., preheating combustion air to 513 degrees.

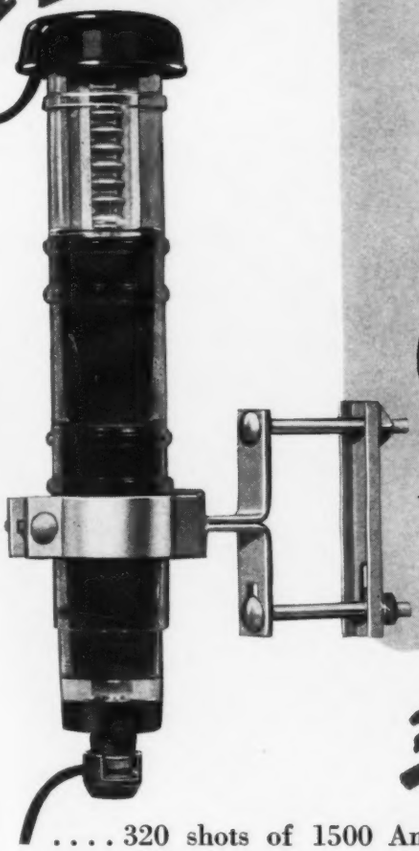
THE AIR PREHEATER CORPORATION

Executive Offices: 60 East 42nd St., New York, N. Y. **Plant: Wellesville, New York**

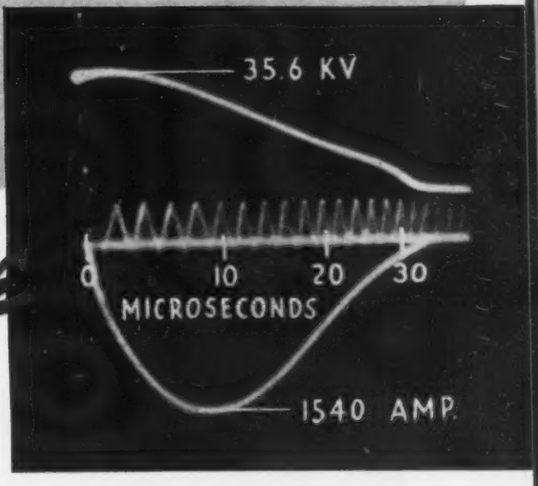
A surge every 15 seconds for 1 hour 20 minutes.. and still going



1st Surge



320th Surge



. . . . 320 shots of 1500 Ampere Standard AIEE surges. The results prove that there is no change in the characteristics of the L-M "Heavy Duty" Lightning Arrester and it gives the same protection as when first put on the line.

In the laboratory a large surge generator hurls custom-made surges at Arresters hooked up for testing. By means of a cathode ray oscillograph, photos of the effects of these surges are recorded. The photos — cathode ray oscillograms — are proof of the low resistance drop, the surge capacity, and the ability to withstand repeated surges. . . . The oscillograms shown here are for the volt-time and ampere-time on the 1st and 320th surge of a L-M 9000 Volt Lightning Arrester. This is the visual proof of but one of the many superior qualities of L-M Arresters. It shows why more equipment than ever before is protected by . . .

LINE MATERIAL CO.

"Heavy Duty" Lightning Arresters

MILWAUKEE, WISCONSIN

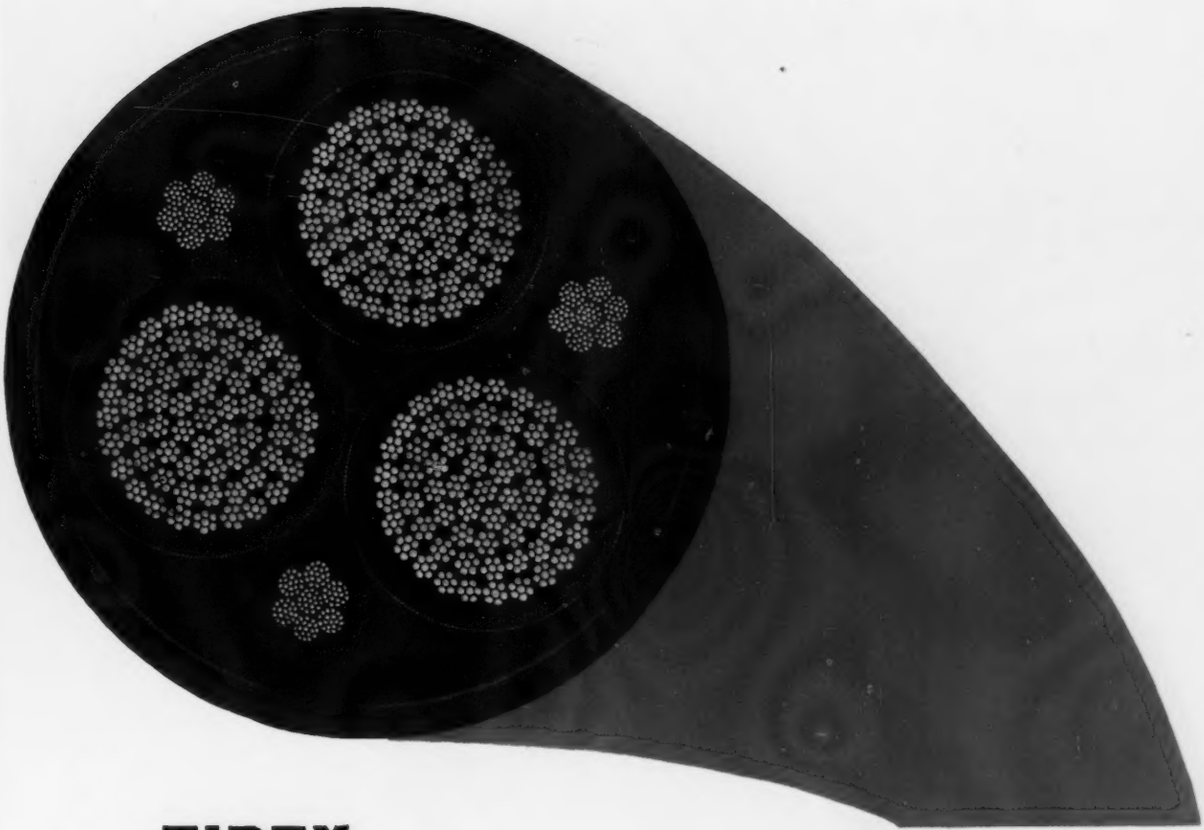
A Handy Index-

. . . where you can at a glance select the electrical connector you need. Every electrical connector manufactured by Burndy is completely described in full detail, in Burndy Catalog No. 40. Here you will also find a technical treatise that is crammed full of important data relating to electrical connectors . . . the most complete reference of its kind, under one cover.

Ask for Burndy Catalog No. 40 — A note on your company letterhead will bring this valuable 325 page reference catalog to your desk by return mail.

Electrical Connectors by BURNDY

BURNDY ENGINEERING COMPANY, INC., 459 E. 133rd STREET, NEW YORK, N. Y.



TIREX
SELENIUM
Rubber Armor
Unequalled for Long-Life Toughness and Resistance to Abrasion.

SIMPLEX TIREX CABLES

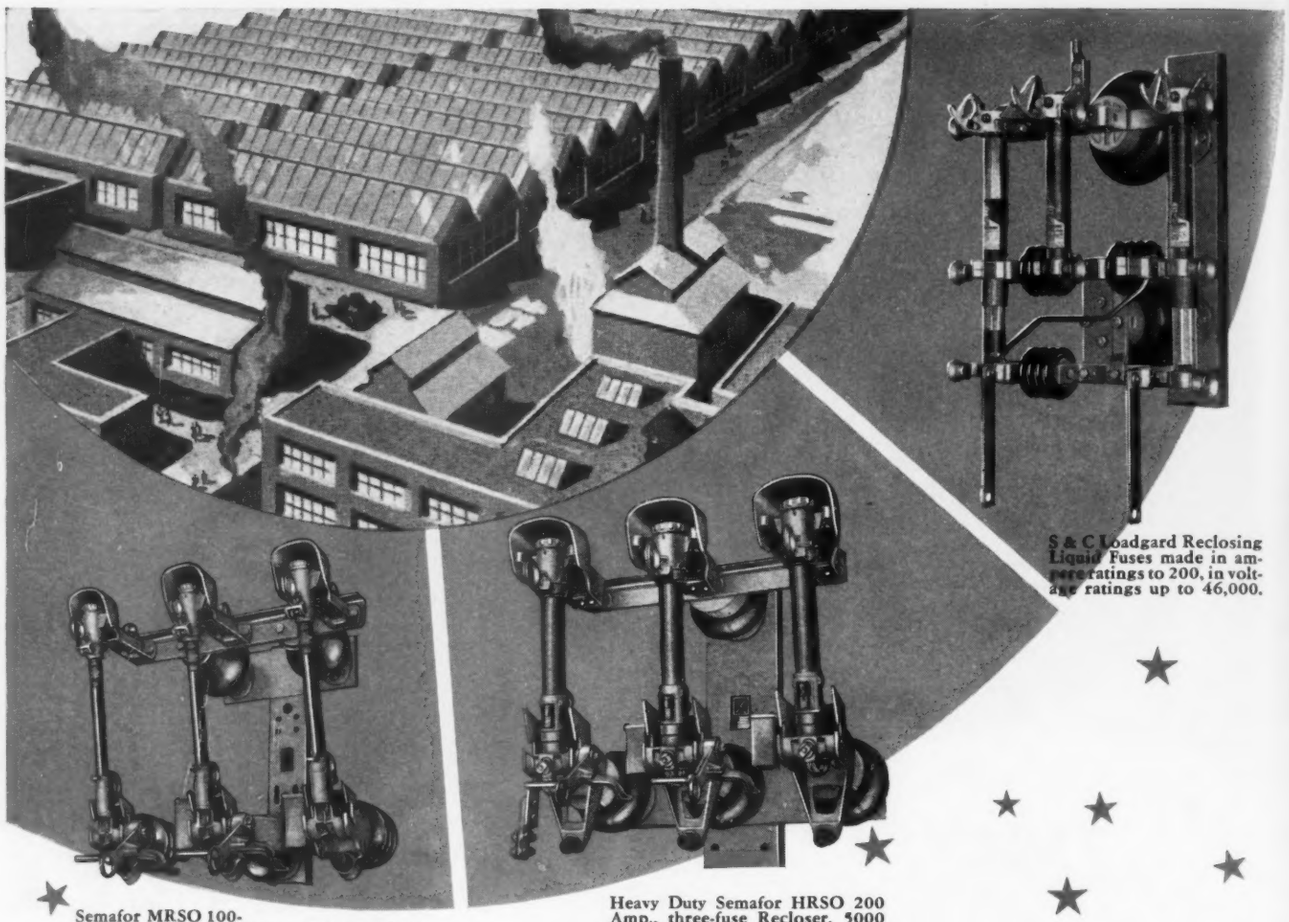
are designed for voltages
from
600 to 15,000

Up to 4 inches outside diameter

Simplex Wire & Cable Company, 79 Sidney Street, Cambridge, Mass.

Simplex – TIREX

The only cable armored with Selenium Rubber



S & C Loadgard Reclosing Liquid Fuses made in ampere ratings to 200, in voltage ratings up to 46,000.

Semafor MRSO 100-Ampere three-fuse Recloser, 5000 to 46,000 volts.—Uses Universal S & C Fuse Links.

Heavy Duty Semafor HRSO 200 Amp., three-fuse Recloser, 5000 to 46,000 Volts.—Uses field replaceable Fuse Units.

Armament Program Puts New Demands on Power Companies for Continuity of Service

S & C RECLOSERS ON INDUSTRIAL SUBSTATIONS REDUCE OUTAGES

Production delays will be more serious when our defense program gets under way. You can safeguard service continuity to big power customers by installing S & C Reclosing Fuse Equipment which re-establishes the circuit automatically after a fault occurs. Operating records show that a sizeable percentage of all faults are self-clearing. In such cases, there are only momentary outages. S&C Reclosers are made in various types and ratings up to 200 amperes, 46,000 volts, and with interrupting ratings up to *10,000 r.m.s. amperes.* There is a type and size to meet your requirements.

Now is the time to do *your* part to insure still greater degree of continuity of service for plants engaged on defense program work . . . Make a survey of your power customers and let us supply the details covering recommended Reclosing Equipment.

Typically S & C in thoroughness of design and construction, S & C Reclosers provide effective, reliable protection at low overall cost.

SCHWEITZER & CONRAD, INC.
4435 Ravenswood Ave., Chicago, Ill.
Manufactured in Canada by Powerlite Devices Ltd., Toronto, Ont.

RECLOSING FUSE EQUIPMENT

Paper cable life multiplied by

ANACONDA TYPE CB CONSTRUCTION!

First successful application of carbon-black to paper cable construction shows remarkable stability in cyclic aging tests!

In severe cyclic loading and aging tests in our laboratories, Anaconda's new Type CB* cable outlasted standard shielded constructions by as much as three to one. The record of this record-making test, available to those interested in the details, plainly reveals the greatly increased stability of Type CB.

To you, this test means there is now available a cable with a definitely lower, *more stable* power factor . . . a cable that minimizes dielectric losses . . . a cable with a life span that brings economy to every user.

When you make your next impregnated paper cable purchase, make it Anaconda Type CB. Meanwhile, if there are any questions concerning its application you would like or need, our engineers will be glad to discuss them with you. 40340

*Reg. U. S. Pat. Off.

ANACONDA
from mine to consumer

USE MODERN IMPROVED *Anaconda Wire & Cable*

ANACONDA WIRE & CABLE COMPANY • General Offices: 25 Broadway, New York City
Chicago Office: 20 North Wacker Drive • A Subsidiary of Anaconda Copper Mining Company • Sales Offices in Principal Cities

See next page for EFFECT OF CARBON-BLACK ON STABILITY IN CYCLIC AGING TESTS

STABILITY OF TYPE CB CABLE CHECKED BY TESTS IN INDEPENDENT LABORATOR

Cyclic aging tests were conducted in an independent laboratory on a 111-foot length of 3-conductor, 500 MCM sector Type CB shielded cable with 130 mil total paper thickness. It consisted of continuous application of 24 Kv, three phase for 28 days with superimposed load cycles.

Figure 1 below was obtained and reported by the independent laboratory. For comparison similar data obtained on standard belted cable are reproduced from a recent A.I.E.E. paper.*

Figure 2 reports the composite power factor, temperature relation taken at all the temperatures during the cyclic aging test on Type CB cable including the initial values. This indicates the remarkable stability of Type CB cable and shows that the use of carbon-black paper offers a simple and unique practical means for increasing the useful sphere of solid type, impregnated, paper-insulated cable.

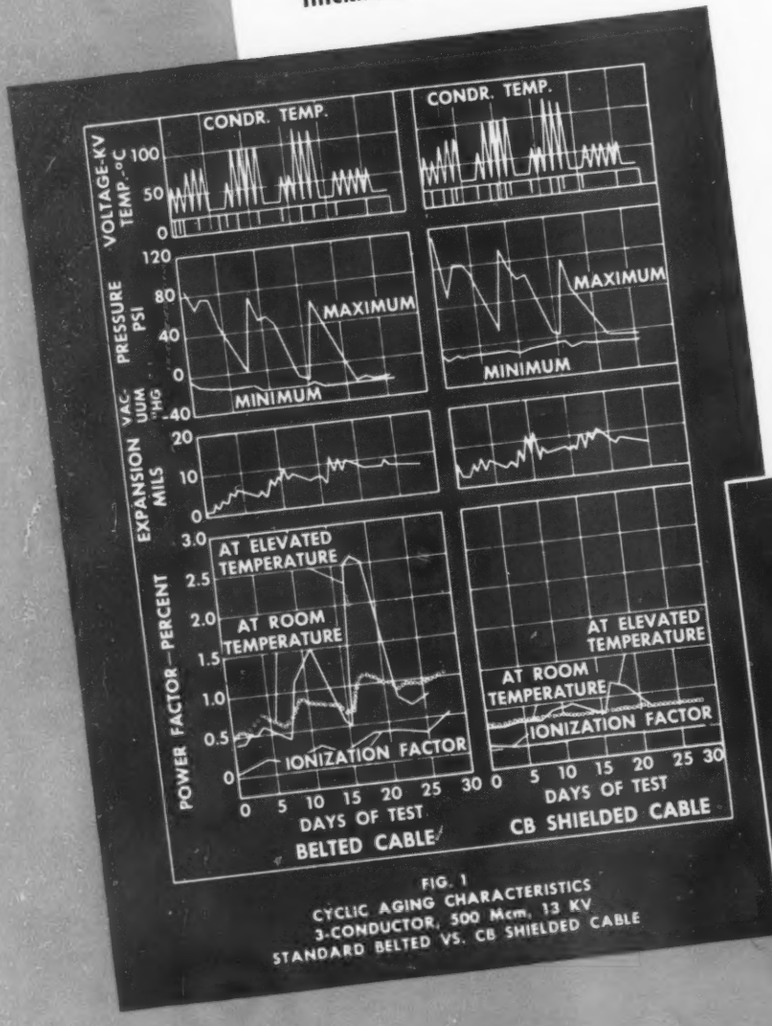


FIG. 1
CYCLIC AGING CHARACTERISTICS
3-CONDUCTOR, 500 Mcm, 13 KV
STANDARD BELTED VS. CB SHIELDED CABLE

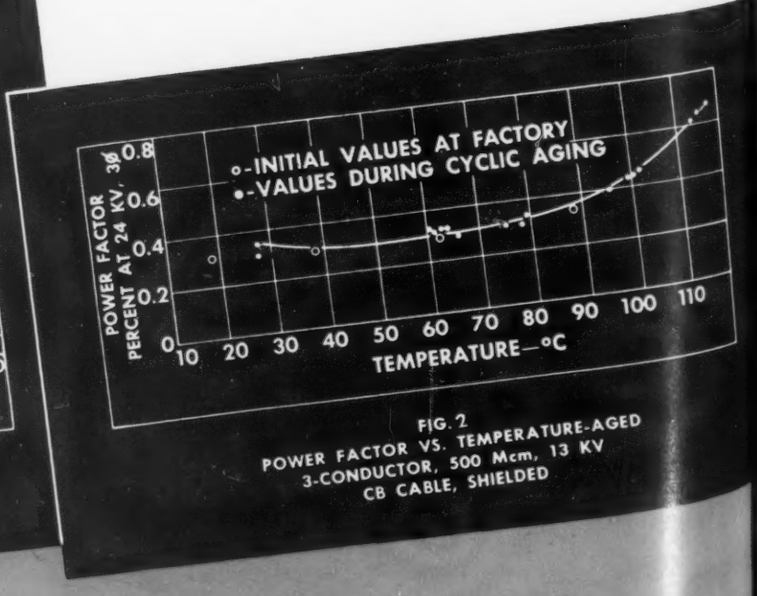


FIG. 2
POWER FACTOR VS. TEMPERATURE-AGED
3-CONDUCTOR, 500 Mcm, 13 KV
CB CABLE, SHIELDED

*Abstracted from A.I.E.E. Technical Paper #40-121, May, 1940—copies available on request.

MAIN OFFICE AND FACTORY

G&W

APPRECIATES THE ORDERS FOR

CABLE TERMINATING
SECTIONALIZING AND
PROTECTING DEVICES

RECEIVED DURING THE PAST YEAR AND WISHES ALL THE BEST FOR YOU IN 1941

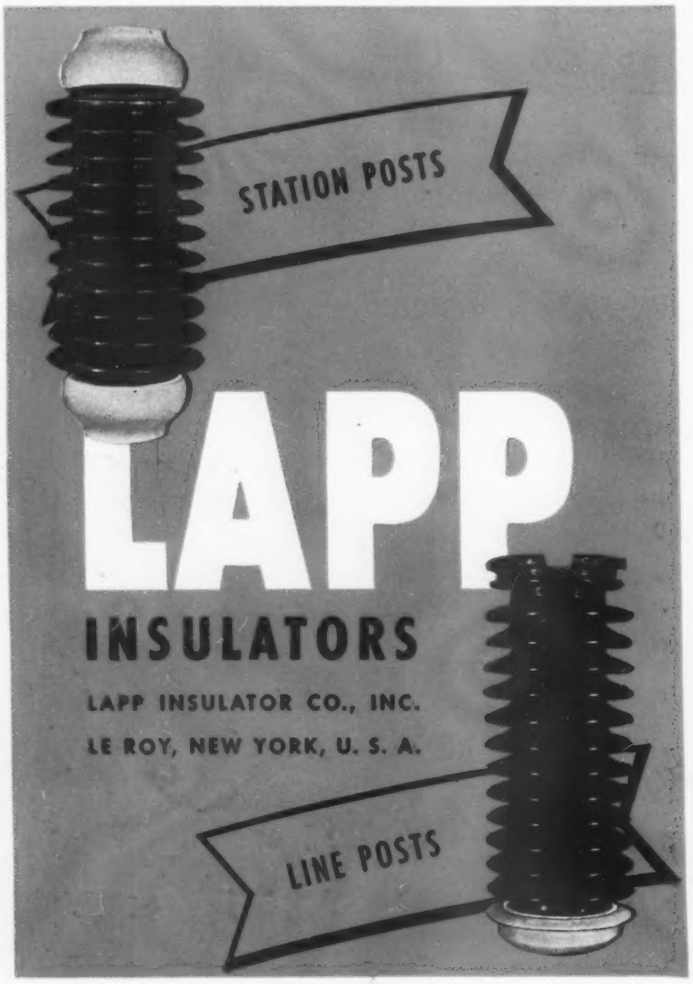
G & W ELECTRIC SPECIALTY CO., 7780 DANTE AVE., CHICAGO, ILL.

PART OF G & W PERSONNEL, 1940

To make the right choice in a station insulator design, you have to know the facts this book contains

The engineer who leaves it to the purchasing department to buy the same type of station insulators that has always been used may be guilty of costing his company needless trouble and expense.

For recent years have seen substantial progress in station insulator design. Most spectacular has been the Lapp Station Post development. Abandoning the conventional approach, Lapp engineers based their efforts on the proposition that most efficient performance of a station insulator depended on its ability to meet several definite requirements—elimination at its source of insulator-caused radio interference, high impact strength, ability to withstand power arc-over, freedom from the possibility of puncture or cracking under electrical or mechanical stress, high rigidity, operating security in fog and dirt conditions without need for frequent cleaning.



In the Station Post design Lapp was able to produce a unit which for the first time met these requirements squarely. Spontaneous acceptance on the part of a large number of engineers and power companies was testimony to the obvious technical superiority of the unorthodox Station Post design.

Today nine years of actual service record should have erased any question of doubt as to the practical performance of the Post unit. Any engineer inclined to on-the-fence thinking owes it to himself to become acquainted with the facts of the case—facts simply and fully explained on pages 61 to 65 of the Lapp catalog. A copy, if you haven't one, is yours for the asking.

the

proved design

for better operating performance

HEADQUARTERS for LIGHTING

AT THE SIGN READING . . .

Westinghouse

NOW . . . when time is at a premium . . . 117 local Distributors offer individualized engineering counsel and complete lighting equipment stocks.

WESTINGHOUSE SUPPLIES THE ANSWER

Providing highly specialized engineering services, improved products and a wealth of lighting experience, Westinghouse is daily helping hundreds of American Industries to speed up production . . . protect plants and property . . . insure better products.

Why not shift this burden of individualized engineering counsel to Westinghouse? This service is always available to you . . . to help you prepare sound lighting recommendations . . . quickly and with the least amount of effort.

Westinghouse offers interior lighting equipment and floodlighting for every commercial and industrial need. These highly-flexible lines include quality-proved fluorescent . . . incandescent . . . and high intensity mercury fixtures. Whatever your customers' lighting requirements may be, there is a Westinghouse product and a Westinghouse plan to improve factory and office illumination.

Start saving valuable time for you and your customers today . . . consult your nearest Westinghouse Lighting Distributor, or write for "Descriptive Data Kit"—Department H, Lighting Division, Westinghouse Electric & Mfg. Co., Edgewater Park, Cleveland, Ohio.

TUNE IN "MUSICAL AMERICANA," N. B. C. RED NETWORK, COAST-TO-COAST, EVERY THURSDAY EVENING.

Westinghouse Lighting Equipment

ELECTRICAL TESTING LABORATORIES • ELECTRICAL TESTING LABORATORIES

Emphasis on the Test Report

Today—with America entering upon major alterations in its economy—

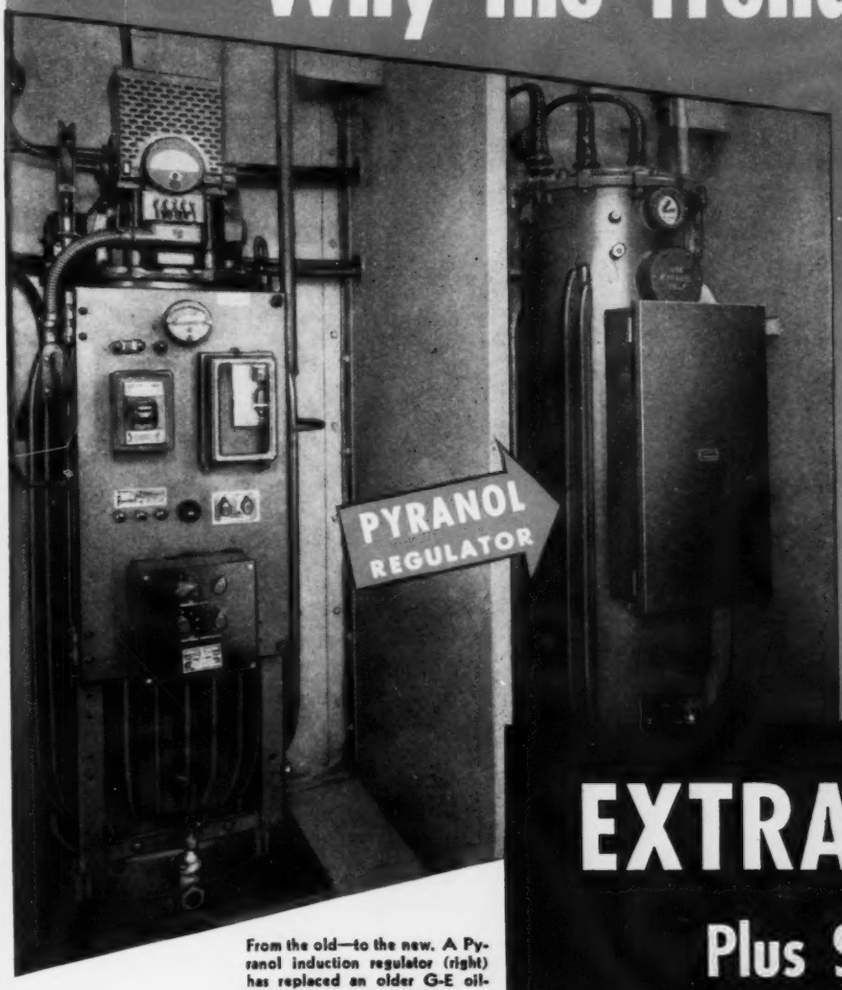
—changes affecting consumer activity
—changes affecting production procedure
—changes affecting materials for manufacture

the TEST REPORT becomes a safeguard for each step.

E T L services strengthen each step of the manufacturer-seller-consumer relationship.

ELECTRICAL TESTING LABORATORIES
79th St. at East End Ave.
NEW YORK, N. Y.

Why the Trend to PYRANOL REGULATORS FOR FEEDER-VOLTAGE CONTROL ?



From the old—to the new. A Pyranol induction regulator (right) has replaced an older G-E oil-filled unit. Part of a modernization program of a large midwestern utility—part of the trend to Pyranol.

EXTRA SAFETY

Plus Savings in Installation Costs

OPERATORS have been quick to recognize the many advantages of the new Pyranol induction regulator. For the first time, they can obtain the safety and economy of Pyranol* in a regulator. Because it is of the *induction* type, this regulator also has the advantage of inherent simplicity of design.

Pyranol can't burn, so these regulators can be installed indoors without the costly cell construction normally used to isolate oil-filled equipment. Both installation costs and space requirements are minimized.

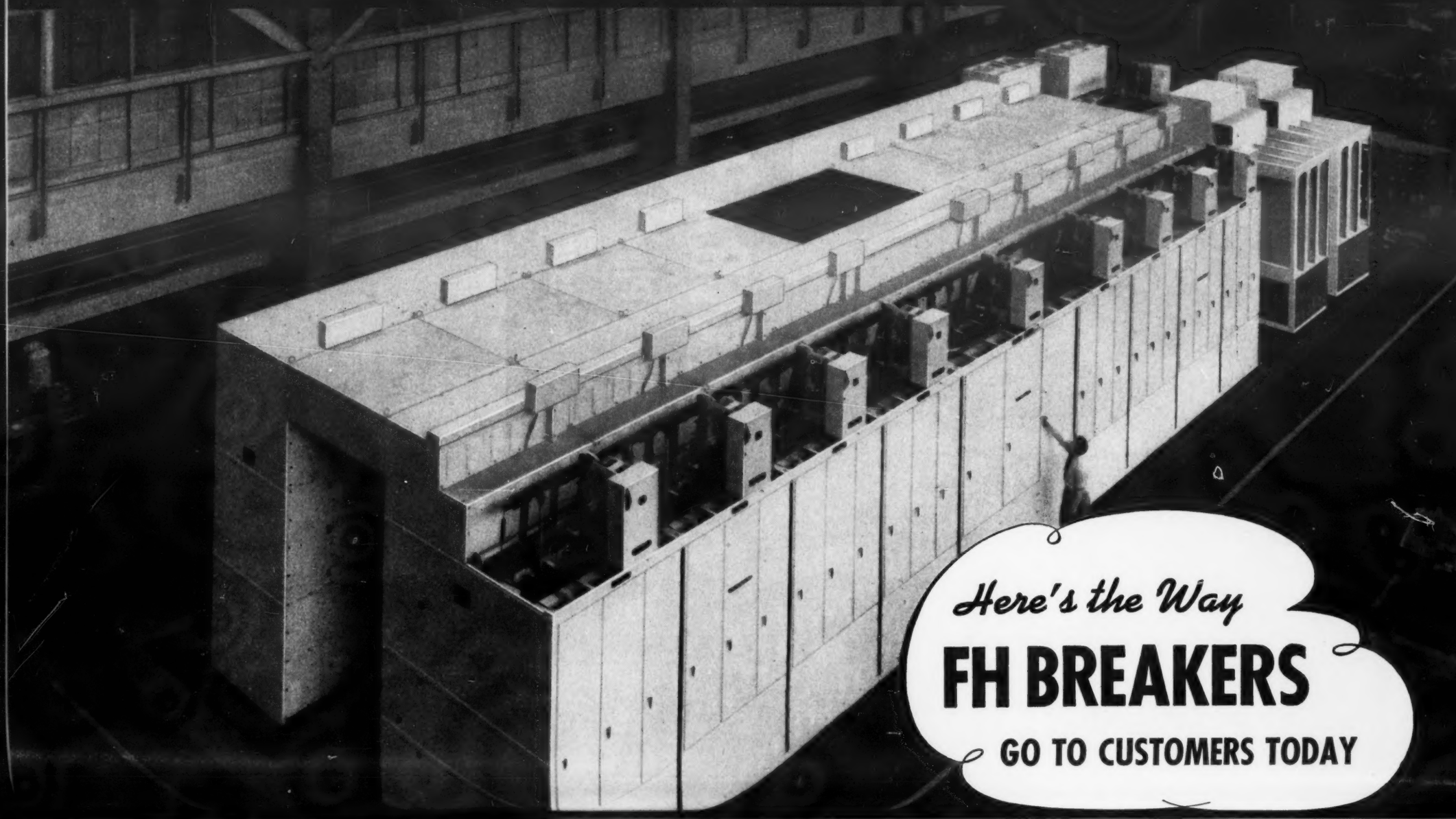
Get complete information on Pyranol regulators from our local representative, or write for Bulletin GEA-3443. General Electric, Schenectady, N. Y.

*Pyranol is General Electric's noninflammable, nonsludging insulating and cooling liquid for electric equipment.

GENERAL ELECTRIC

404-11

Let's Bring You *Up to Date* on Station-type Switchgear



Here's the Way

FH BREAKERS

GO TO CUSTOMERS TODAY

J. L. HEMPHILL & CO. Inc.
ELECTRICAL ENGINEERS AND EQUIPMENT
1600-1604 53rd Street, North Bergen, N. J.
N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: PAlisade 6-2600
HOWARD B. JOHNSON, 53 W. Jackson Blvd., Chicago, Ill., Chicago Representative

MOTOR GENERATOR SETS

1—500-kw., 250/125 volt, G.E., Synchronous.
1—500-kw., 600 volt, General Electric, Synchronous.
2—500-kw., 250 volt, General Electric, Synchronous.
1—150-kw., 250-V., Westinghouse, Synchronous.
1—100-kw., 250-V., Synchronous.
1— 75-kw., 125-V., Crocker-Wheeler, Synchronous.
1— 50-kw., 125-V., G.E., Sq. Cage.
1— 50-kw., 250-V., G.E., Sq. Cage.
1— 40 kw., 125-V., Westinghouse, Synchronous.
1— 35-kw., 125/250-V., General Electric, Sq. Cage.
2— 30-kw., 32 volt, ball bearing, squirrel cage.

TURBINES

1—500 kw., General Electric, 3 phase, 60 cycle, 480 volt bleeder.
1—300-kw., 3 phase, 60 cycle, 220 volt, General Electric, condensing.
1—250-kw., Westinghouse, 3 phase, 60 cycle, non-condensing.
1—200-kw., General Electric, condensing.
2—150-kw., Westinghouse, 125/250 v., non-condens.

TRANSFORMERS

1—15,000-kva., Pittsburgh, 3 phase, 26,000/4150 v.
3—400-kva., Wagner, 2200/220-440 volts.
3—400-kva., Moloney, 4150/2400-220/440 volts.
4—300-kva., Pittsburgh, 4600/115/230 volts.
4—200-kva., Pittsburgh, 7800/220/110 volts.
2—200-kva., General Electric, 2200/220-440 volts.
3—150-kva., Pittsburgh, 6600/440 volts.
2—150-kva., West. 2300/330/115-V. Scott Taps.
3—150-kva., General Electric, 33,000/2300 volts.
6—100-kva., Wagner, 2200/220-110 volts.
3— 75-kva., Pittsburgh, 2400/120 volts.
2— 50-kva., General Electric, 2200-220/110 volts.
2— 50-kva., Kuhlman, 2200/110-220 volts.
3—37½ kva., General Electric, 2400-240/120-V.
3—25 KVA, Paranol cooled, 2200-220/110 volts.
3—25 KVA, Westinghouse, 440/220-220/110 volts.

MOTORS—3 PHASE, 60 CYCLE

No.	H.P.	R.P.M.	Volts	Type
1	720	360	440	G.E. Syn.
1	500	450	2300/4000	G.E. Sl. Rg.
1	400	514	440	West. Sl. Rg.
1	350	300	440	G.E. Sl. Rg.
1	350	100	220	G.E. Syn.
2	335	600	2200	G.E., Syn.
1	300	600	2200	G.E. Sl. Rg.
1	250	450	440	G.E. Sl. Rg.

Variable Speed 230 Volt Motors

H.P.	R.P.M.	Type
1—150	300/900	Westinghouse
90	470/940	G.E.
75	235/950	Burke
35	500/1500	G.E.
30	600/1200	West.
25	300/1200	G.E.
4— 20	400/1200	G.E.
3— 15	300/1200	G.E.

ENGINE SETS

21x24 Ames Uniflow, direct connected 250 KW, 3 phase G.E. Generator.
13x15 Skinner Uniflow, 150/300 RPM, engine only.
80 HP, Fairbanks-Morse Diesel, 65 KVA, 300 RPM, direct connected, 3 phase generator.

Complete Line of A.C. and D.C. Motors and Generators

—TRANSFORMERS—

A Complete Stock **Prompt Shipment**

3—500 KVA Gen. Electric Transformers, 60 cycle, 23000-6600 volts **$1025.00 EACH**

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 135-A

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

OIL SWITCHES

Send for stock list #78 just issued, showing a complete line of Reconditioned OIL CIRCUIT BREAKERS, CURRENT TRANSFORMERS and related SWITCH GEAR.

J. P. MANYPENNY
212 North 21st St., Philadelphia, Pa.

RE-NU-BILT MOTORS GENERATORS TRANSFORMERS LARGE & HEAVY ELECTRIC POWER EQUIPMENT

Thoroughly Tested Before Shipment and Guaranteed

MORE THAN 50% SAVING

BELYEA CO. INC.
51 HOWELL STREET
Jersey City, New Jersey

POSITIONS WANTED
(Continued from opposite page)

ELECTRICAL ENGINEER—Experience in construction and maintenance in large industrial plant—capable of superintending electrical installation in new industrial plant, desires change. PW-643, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

SELLING OPPORTUNITIES
OFFERED—WANTED
Selling Agencies—Sales Executives
Salesman—Additional Lines

OPPORTUNITY OFFERED

ARE YOU PROPERLY REPRESENTED in Southern California" Sales Engineer with extensive experience and valuable contacts, offer representation for electrical, machanical or natural gas equipment. Manager, 256 El Camino Drive, Beverly Hils, Calif.

OPPORTUNITIES WANTED

For best informed sales representative in Government contract work, write Riddell, 300 B-st., S.E. Washington, D. C.

CANADIAN Representation AVAILABLE

The utilities, and large industrial firms in Canada are working to almost capacity production.

The advertiser is a sound successful Canadian company, operating a well trained sales staff, and manufacturing electrical equipment.

We can give seasoned representation in the busy Canadian market to the proper product sold to public utilities and large industrials.

Correspondence will be treated in confidence. Write to

RA-813, Electrical World
330 West 42 St., New York City

WANTED

WANTED
GENERATOR
100 KVA, 3 phase, 60 cycle A. C. Generator, 1200 RPM.
JOHN REINER & CO., Inc.
12-12 37th Ave. Long Island City, N. Y.

It will interest you to know—

An advertiser writes: "It will interest you to know that we have been getting excellent inquiries from our ad in the Searchlight Section of Electrical World.

"We are now negotiating with a concern (reply to our ad) and it is likely to bring a *BIG* Sale.

"Also, we have just closed a sale from an inquiry in response to an ad we ran in Electrical World over a year ago."

You, too, can use "Searchlight" advertising in your business, profitably. Just write to—

Departmental Advertising Staff

ELECTRICAL WORLD

330 West 42nd St., New York City

ADVERTISING IN THIS ISSUE

• *Here are displayed more goods and services used in the electrical industry than in any other place. Here you'll find the answers to many of your questions about What's new in the market? What products or methods will save me time and money? It's a good habit to follow the pages in Electrical World each issue. You never know when some new idea will pay you a profit.*

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*Allis-Chalmers Mfg. Co.....8, 9, 66, 67, 69
Anaconda Wire & Cable Co....23, 24
Atterbury & Co., N. W..... 100
Autocall Company 99

Barker & Wheeler..... 100
*Biddle Co., James G..... 97
Black & Veatch..... 100
Burndy Engineering Co..... 20

Cheney and Co., E. J..... 100
Cooper & Co., Hugh L..... 100

Day & Zimmermann, Inc..... 100
Delta-Star Electric Co..... 98
Directory of Engineers..... 100

Electrical Testing Laboratories.28, 100
Electromaster, Inc. 80
Engineers, Directory of..... 100

Foley, Robert E..... 100
Ford, Bacon & Davis, Inc..... 100
Fowle & Co., Frank F..... 100

G & W Electric Specialty Co..... 25
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General Radio Corp..... 87
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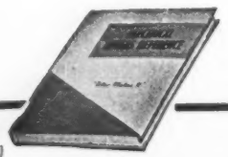
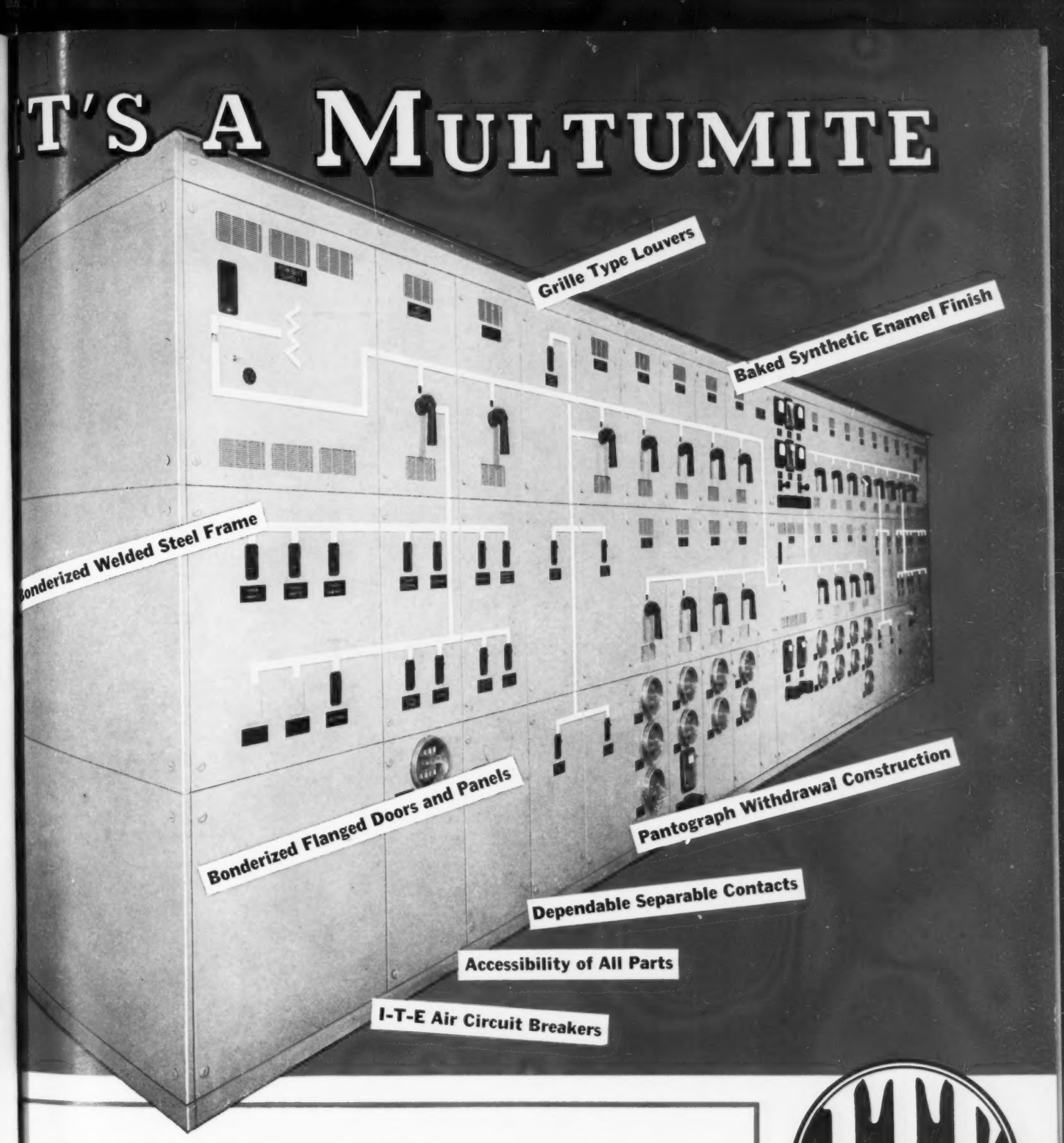


*** These companies have supplied additional buying information on their products in the 1940 edition of the Electrical Buyers' Reference, published by Electrical World**

T'S A MULTUMITE



Multumite is steel-enclosed switchgear designed and built by I-T-E. It is identifiable by refinements which are well in advance of common practice.

Some standard Multumite improvements are named on this page. Specify them . . . Multumite switchgear costs no more and it is better.

Representatives in Principal Cities

Shown above is a new Multumite switchboard, for 575-volt service, which combines in one dead-front, steel-enclosed unit 25 magnetic circuit breakers and 34 thermally-operated circuit breakers. Mounting includes both the use of pantographs with separable contacts for withdrawal and rigid connection to the bus. Meter sockets of the plug-in type are provided. Color is gray with a mimic bus in yellow.

T·E CIRCUIT BREAKER CO., PHILADELPHIA, PA.

"KUHLMAN C.S.P. TRANSFORMERS

are sure cutting our maintainance costs."

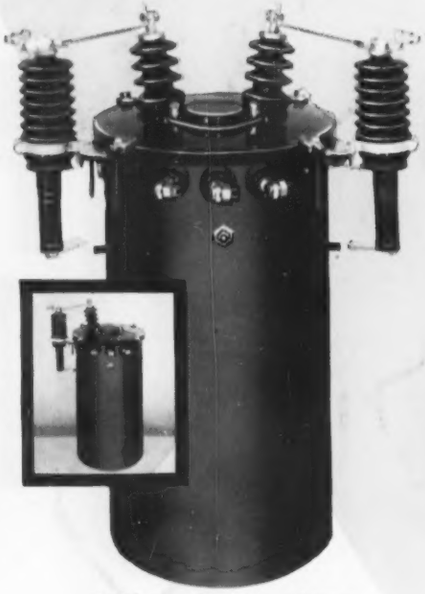
"We maintenance men think Kuhlman CSP transformers are the 'buy'. Because of their patented B.I. core, they are lighter. Because of their handy, oversize lifting lugs they are easier to handle, easier to install. Because of their porcelain enameled tanks they require no repainting. Because of their self protecting features they quickly locate any line defects in rural and suburban installations. And because of their unusually rugged construction they stand up on the job, year after year."

. . . KUHLMAN C. S. P. TRANSFORMERS AUTOMATICALLY PROTECT THEMSELVES AGAINST FAILURE DUE TO OVERLOADS AND SURGES

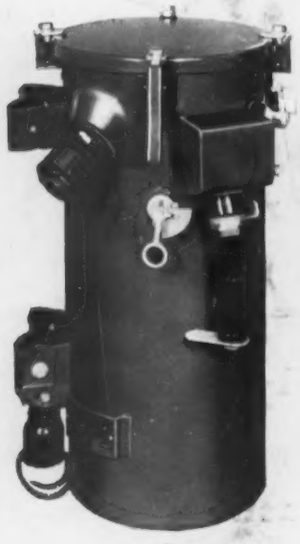
Protection against secondary short-circuits and dangerous overloads is provided by a circuit breaker which is tripped by the combined thermal effect, on a bimetal element, of the load current and oil temperature. When the transformer is consistently operating above normal temperatures, an automatic signal lamp indicates this condition.

De-ion gaps protect the transformer against overvoltages from lightning and all other causes by equalizing stresses from the Primary winding to case and core. These gaps utilize the principle of bypassing the power of a lightning surge rather than absorbing it. The gaps provide a path of practically zero impedance at the instant of breakdown.

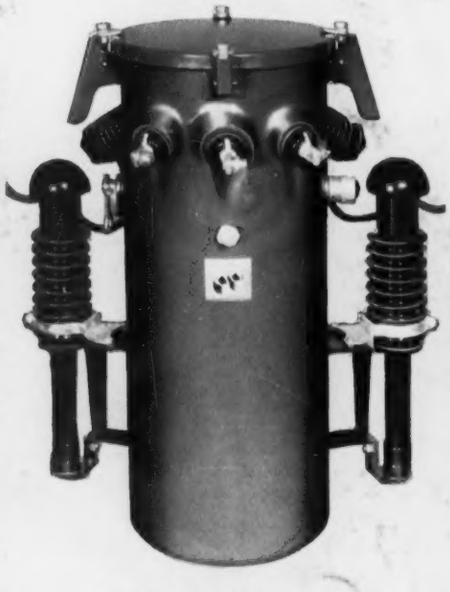
As a final protection, internal fusible links, coordinated with line fuses, prevent line outages by disconnecting the transformer from the line in the event of failure from any cause.



Kuhlman CSP Transformer with cover bushings and external De-ion gaps. Inset shows one-cover bushing.



Kuhlman CSP Transformer with pocket bushings and internal De-ion gaps. Note sturdy, extra large lifting lugs.



Kuhlman CSP Transformer with pocket bushings, external De-ion gaps and TR breaker with signal lamp.

Kuhlman B.I. core and co assembly for a Kuhlman CS Transformer with TR breake with signal lig t.

Kuhlman ELECTRIC COMPANY, BAY CITY, MICHIGA